WINTER QUARTERS CANYON DATA ADEQUACY

APPENDICES F, G, H, AND I

CULTURAL RESOURCES
AIR QUALITY
VEGETATION AND LAND USE
SOCIOECONOMICS

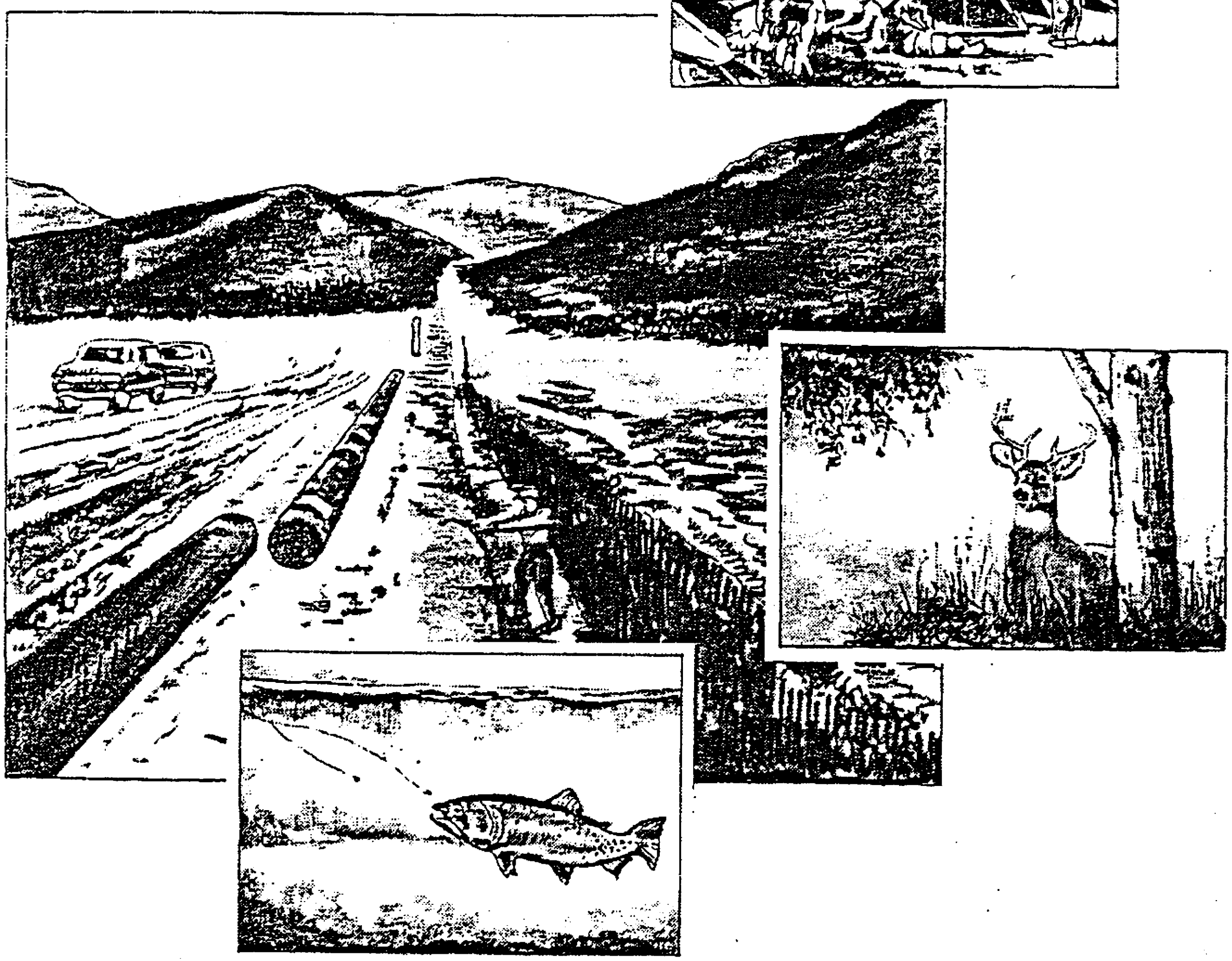
VOLUME 3

APPENDIX F

CULTURAL RESOURCES

QUESTAR PIPELINE COMPANY'S
MAIN LINE No. 41
FINAL ENVIRONMENTAL IMPACT STATEMENT
DAMES & MOORE, 1990

Questar Pipeline Company's



Main Line No. 41
Reroute at Skyline Mine

Final Environmental Impact Statement

US Department of Agriculture
Forest Service, Manti-La Sal National Forest

JULY 1990
Dames & Moore

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CULTURAL RESOURCES

Important or potentially important cultural resources along the proposed routes include a prehistoric camp site, an abandoned railroad, three potentially sensitive historic localities, and four areas where there is a possibility of encountering buried Pleistocene vertebrate remains, which could be of both archaeological and paleontological importance. Predictive cultural resource sensitivity assessments categorized the areas within each route as having high, moderate, low, or no sensitivity.

Direct, adverse physical impacts can occur to cultural resources during construction, while indirect impacts may result from increased traffic, which can increase site vandalism. Mitigation measures include avoidance or data recovery. Application of these measures should reduce impacts to an acceptable level.

Background

Federal regulators charged with implementing the Nation's historic preservation program have broadly defined cultural resources as buildings, sites, districts, structures, or objects having historical, architectural, archaeological, cultural or scientific importance. In implementing this definition it has become common practice to delineate three basic categories of resources: (1) prehistoric resources, (2) historic era sites, and (3) ethnographic sites.

Prehistoric resources are defined as sites and associated artifacts that date from before the time of written records, which do not appear before the arrival of Spanish explorers. These resources represent Native American cultures and societies. The importance of these resources generally stems from their potential to yield valuable information about prehistory and the development of human cultures. Prehistoric sites with important information potential are afforded special status under Federal and State historic preservation guidelines (e.g., the National Historic Preservation Act of 1966, as amended in 1976 et seq. (Public Law 94-422); NEPA (Public Law 91-190); and Protection and Enhancement of the Cultural Environment (Executive Order 11593) and the Utah Antiquities Act of 1969 (Utah Code Ann., Section 63-11-2).

Historic resources are defined as those sites or properties that were occupied or used after the time when written records became available; for much of Utah, this did not occur until the early 1800's. Ordinarily, properties must be at least 50 years old in order to be deemed historic. The importance of such resources, as viewed from the perspective of Federal and State preservation guidelines, lies in their potential to yield important historic information, or from their association with historically important persons or with events that have made a meaningful contribution to the broad patterns of history, or because they represent characteristic styles or the work of a master.

Ethnographic resources are locations of contemporary or heritage importance to Native Americans. Major Federal legislation that requires the consideration of ethnographic considerations in environmental documents includes the same laws that protect prehistoric and historic resources as well as the American Indian Religious Freedom Act (Public Law 95-431).

In 1989, archaeologists from Dames & Moore completed several tasks to determine the effects of each alternative on cultural resources. These included:

- Review of Manti-La Sal National Forest and the Utah State Historic Preservation office cultural resource records for information on previous cultural resource projects within the project area.
- Review of General Land Office records for information on potential historic localities.
- Consultation with Dr. David Madsen, Utah State Archaeologist for information to identify areas with the potential for containing buried Pleistocene mammal remains.
- An intensive, 100 percent pedestrian survey of all segments on National Forest System lands with the exception of the existing route and portions of Segment 24 that had been assessed previously for potential cultural resources in conjunction with the construction of Utah Highway 264 (Bruder, Bassett and Rogge 1990).

In addition, a contact program has been initiated by the Forest Service among local Native American communities soliciting information about any cultural resources having special importance for them.

Existing data indicate that cultural resources in the general study area consist largely of historic properties associated with coal mining activities and related occupation of the region. Prehistoric sites are rare; however, there is reason to believe that evidence of very early human activities associated with the remains of extinct Pleistocene fauna such as mammoths and mastodons may be present.

Known Cultural History

Prehistoric Period - Very little archaeological evidence is available regarding the prehistoric occupation of that portion of the Wasatch Plateau where the project is located. However, excavations in the adjacent eastern Great Basin indicate that earliest humans may have arrived in the general region approximately 15,000 years ago (Gruhn 1961). Artifacts typical of the earliest several thousand years of occupation are often associated with remains of now extinct elephants, camels and bison indicating that they were hunted by the earliest, Paleo-indian inhabitants. Moister and cooler conditions characterized the climate at that time.

Evidence concerning Paleo-indian occupation in Utah is exceedingly sparse (as summarized by Black and Metcalf 1986). However, remains of a Columbian mammoth (Mammuthus columbi) were recovered from the Huntington Reservoir area near the project area and two mastodons (Mammut americanum) have been recovered from sinkholes near Skyline Drive within the study area (Intermountain Reporter 1989; Miller 1987). Radiocarbon dating suggests that the mammoth dates to approximately 11,000 before present (Madsen 1990).

The subsequent era of occupation is known as the Archaic and dates from approximately 8300 to 1500 BP in many parts of the region (Schroedl 1976; Jennings 1978; Black and Metcalf 1986). The nomadic hunting and gathering Archaic cultures apparently reflect an adaptation to a climate much drier and warmer than the previous era.

Sites of the horticulturally based Fremont culture appear throughout much of Utah around AD 500. A three phase sequence, beginning possibly as early as AD 150 and ending at about AD 1200, has been postulated for the San Rafael Fremont variant whose occupation zone is located immediately east of the study area (Black and Metcalf 1986). Early Fremont sites suggest a trend toward seasonal sedentism. Later sites typically are small villages situated along streams and on small knolls above water sources. There is some evidence to indicate that near the end of the sequence, San Rafael Fremont groups aggregated into fewer but larger sites situated adjacent to arable land.

The appearance of distinctive side-notched points and ceramics around AD 1250 reflects the eastward expansion of presumed Shoshone-speaking hunters and gatherers out of the southwestern Great Basin (Holmer and Weder 1980). The Fremont sites disappear at about this time although the reason for this coincidence has not been resolved (Hauck 1979; Nickens 1982).

Ethnohistory Period - The Utes, a Shoshonean population, were the sole inhabitants of east-central Utah at the time of Euro-American contact (Steward 1938). They subsisted by hunting and gathering wild foods in a manner very similar to the Archaic era occupants (Euler 1966; Wheat 1967; Smith 1974; Jennings 1978). The introduction of the horse around AD 1700 profoundly changed their way of life (Stewart 1966). As traffic along the emmigrant trails increased and Mormons began to settle Utah in the 1850's and

1860's, the Native Americans came into more and more conflict with the Americans. The Utes were confined to the Uintah Reservations north and east of the study area during the 1870s.

Historic Period - With the exception of the brief Dominguez-Escalante expedition of 1776-1777, the initial intrusion by Euro-Americans into present-day Utah was by fur trappers in the early 1800's. While never great in number, these traders and explorers were effective in causing the Indians to become dependent on manufactured goods, in contributing to the extinction of the bison west of the Continental Divide, and in publicizing the region to eastern interests.

Following an ill-fated attempt on the part of the Mormons to settle the Wasatch Plateau and surrounding areas in 1855, the region was abandoned until 1877. In that year, members of the Sanpete Stake founded agricultural settlements in Castle Valley. Later, cattle and then sheep were grazed within the general region.

Coal was discovered at Connellsville in Huntington Canyon in 1875, and there was an unsuccessful attempt to produce coke there. In 1876, the Pleasant Valley Road was constructed, and the following year high-quality coal was being mined at the Number 1 Mine in Winter Quarters Canyon. This was the first successful commercial coal mine in Utah (Watts 1948). Mining continued there until 1928 despite abortive attempts to organize labor and resulting unrest, an attempt by the railroads to monopolize production, and a tragic mine explosion in 1900, which claimed 199 lives.

Several communities were established in or near the study area to service the mining industry. The company town at Winter Quarters grew to a population of around 800 and had at various times, segregated communities of Welsh or British, Finnish, Greek, and Slavic miners and their families. Many miners opted to settle in the independent town of Scofield, near the railroad, or at Clear Creek, a mill town that later developed its own mines. The aforementioned mines, along with the UP Mine and Mud Creek Mine constituted the Pleasant Valley Coal District for many years.

Although mining continues to be the dominant commercial venture in the region, the ranching, and more recently the recreational industries, have also made use of the study area. The region shows evidence both of summer sheep herding and use by hunting and fishing enthusiasts as well as containing scattered summer homes on private inholdings within the Forest.

Specific Descriptions - Cultural Resources in the Project Area

Within the general study area (which includes all of the US Geological Survey (USGS) Scofield Reservoir and Fairview Lakes quadrangles, and small portions of the C Canyon and Jump Creek quadrangles), 19 previous cultural resource surveys have been undertaken. About 1.5 miles of previous surveys are along the existing pipeline corridor. These studies located 3 archaeological sites on or very near (within 1/8 mile) the proposed routes or the existing pipeline.

In addition, the locations of various historic manifestations (primarily roads) were obtained from Government Land Office (GLO) township maps dating between 1876 and 1931. Table 3-13 lists both the previously recorded archaeological sites and the potential historic site locations from the GLO maps. It should be noted that except where these historic locations have been field checked, we cannot be certain they still exist. Thus, as noted on Table 3-13, the integrity and potential eligibility for listing on the National Register of Historic Places (National Register) for many of these resources has not been determined.

The 3 previously recorded sites include 1 prehistoric lithic scatter, 1 prehistoric camp site, and 1 historic limited activity site containing a corral, inscribed aspens and trash. Previous recorders have recommended that 2 of the archaeological sites are not eligible for listing on the National Register, but that the prehistoric camp site (42CB334) is eligible.

The 25 potential historic locations include 1 railroad, 1 sawmill, 1 coal prospect, and 22 roads or trails. The presently unused Denver and Rio Grande Western Railroad is extant but its historical integrity and National Register eligibility have not been determined. No trace of the sawmill was found during our field inspections and we assume that either it is no longer extant or it was misplotted on the GLO maps. The condition and National Register eligibility of the coal prospect is unknown.

Most of the roads apparently are narrow bladed tracks that may have been associated with logging, or other temporary access needs, but 5 were more substantial transportation corridors. These are the Skyline Road (now Skyline Drive), noted as early as 1892; the Pleasant Valley Road, which headed northwest from Winter Quarters Camp (1891); the Winter Quarters Camp Road, which connected the company town with Scofield to the east and also apparently was paralleled by a spur railroad track at one time (1876); the Scofield Road, which today is Utah Highway 96 (1876); and the Price Road, which headed towards Price from its intersection with the Scofield Road about 2.75 miles north of Clear Creek (1915).

We suggest that the 5 main transportation corridors might qualify for National Register listing under criterion "a" because of their association with the development of early mining in Utah. However, as noted, at least within the project area or at least where crossed by the alternative routes, 4 have lost their integrity due to grading, widening, and in 1 case paving. There may, however, be well-preserved, National Register eligible segments located outside of the project area. Therefore, if these linear features are eventually considered for National Register listing, those stretches which might be affected by this project would be considered non-contributing elements. The integrity of the fifth major route (the Price Road) is unknown.

We note, however, that the 5 main routes could predict the presence of nearby, unrecorded historic sites. The National Register eligibility of the smaller roads has not been determined, but some have lost their integrity where they are crossed by the alternative routes.

Five groups and 10 isolated occurrences of carved aspen trees were located by the survey as shown on Table 3-13. We recommend that they are not eligible for listing on the National Register and that our recording has essentially exhausted their information potential.

The contacts initiated with local Native American communities have, to date, not resulted in the identification of any traditional use areas or sites having special importance or sacred values.

TABLE 3-13
ARCHAEOLOGICAL SITES AND HISTORIC LOCALITIES

	SITE / LOCALITY	SEGMENT	ROUTE	CONDITION
	Previously Recorded Sites			
1	42EM1306 (lithic scatter)	16, 24	Burnout Canyon	west of Fairview Road (relationship to route undetermined); recommended not eligible
2	42EM1496 (corral, inscribed aspens, historic trash)	18	Existing	east of pipeline (should not be affected); recommended not eligible
3	42CB334 (prehistoric campsite)	20	Winter Quarters	relationship to route undetermined; recommended eligible
	Newly Recorded			
1	42SP218 (inscribed aspens)	1	Gooseberry	on route (will be affected); recommended not eligible
2	42SP219 (inscribed aspens)	1	Gooseberry	on route (will be affected); recommended not eligible
3	42SP220 (inscribed aspens)	1	Gooseberry	on route (will be affected); recommended not eligible
4	42SP221 (inscribed aspens)	14	Burnout Canyon	on route (will be affected); recommended not eligible
5	42EM2195 (inscribed aspens)	3b	Burnout Canyon	on route (will be affected); recommended not eligible
	Potential Historic Locality			
1	Skyline Road, 1892	1, (3)*	Gooseberry	integrity lost within the project area
2	trail, 1929	1	Gooseberry	west of route (should not be affected); eligibility unevaluated
3	road,1929	1	Gooseberry	west of route (should not be affected); eligibility unevaluated
4	road, 1892	1	Gooseberry	west of route (should not be affected); eligibility unevaluated
5	road, 1892	1	Gooseberry	integrity lost where crossed by alternate route
6	road, 1891	1	Gooseberry	south of route (should not be affected); eligibility unevaluated
7	road, 1891	1	Gooseberry	unknown; eligibility unevaluated
8	road, 1931	1, 2, 16, 24	Gooseberry, Burnout Canyon	integrity lost where crossed by alternate route
9	road, 1931	1	Gooseberry	dirt road; eligibility unevaluated
10	road, 1931	16, 24	Burnout Canyon	integrity lost where crossed by alternate route
11	road, 1931	1, 2, 3a, 3b, 11, 16, 18	Existing, Burnout Canyon	dirt road; eligibility unevaluated
12	road, 1931	3b	Burnout Canyon	dirt road; eligibility unevaluated
13	sawmill, 1931	4	Burnout Canyon	not extant
14	road, 1931	4, 5, 6, 9	Burnout Canyon	dirt road; eligibility unevaluated
15	road, 1931	6	Burnout Canyon	west of route (should not be affected); eligibility unevaluated
16	Pleasant Valley Road, 1891	12, 13, 20	Existing, Winter Quarters	integrity lost where crossed by alternate route
17	road, 1931	18	Existing	unknown; eligibility unevaluated
18	Winter Quarters Camp Road/Railroad,1876	20	Winter Quarters	integrity lost where crossed by alternate route
19	Scofield Road, 1876	19, 20, 21, 23	Winter Quarters	integrity lost within project area
20	Denver & Rio Grande Western Railroad	19, 20, 21, 23	Winter Quarters	extant; integrity and eligibility unevaluated
21	coal prospect, 1876	21	Winter Quarters	unknown; eligibility unevaluated
22	Price Road, 1915	20, 21, 22	Winter Quarters	unknown; eligibility unevaluated
23	road, 1915	22	Winter Quarters	unknown; eligibility unevaluated
24	road, 1915	22	Winter Quarters	unknown; eligibility unevaluated
25	road, 1915	23	Existing	unknown; eligibility unevaluated

* Intersects route more than once

Potentially Sensitive Areas

In sum, important or potentially important cultural resources of which we are aware along the proposed routes include a single recommended National Register eligible site (42CB334, the prehistoric campsite), the unused Denver and Rio Grande Railroad, and 3 potentially sensitive historic localities on the Winter Quarters Route: Scofield Road, Winter Quarters Camp Road, and the old road leading toward Price, which is part of Segment 22. (No historic remains were located where the alternate routes would cross or parallel the Skyline and Pleasant Valley roads.) In addition, we have identified 4 areas where there is a possibility of there being buried Pleistocene vertebrate remains. These are low, boggy areas (physiographically similar to the sediment trap in which the Huntington Reservoir mammoth was encountered) along Gooseberry, Upper Huntington, and Mud Creeks.

Using data from the field inventory and records review, we have assigned sensitivity rankings along each of the proposed routes. For those stretches where we or others have undertaken intensive pedestrian surveys and found no eligible sites or where the Forest Service has consulted previously with the State Historic Preservation Officer and determined the potential for cultural resources is too low to warrant survey, we have assigned a sensitivity ranking of "none". Also included here is the existing pipeline corridor that has already been disturbed and therefore would not be expected to contain intact deposits even if any cultural resources had been there originally. Stretches of low sensitivity are those areas on non-National Forest lands that have not been surveyed, but where the potential for encountering cultural resources is considered to be minimal based on the results of intensive survey on National Forest land with similar topography, slope, and other environmental conditions. Areas of moderate sensitivity are those where Pleistocene vertebrates, or historic resources could potentially be encountered, but where their presence has not been verified. A single stretch along Mud Creek is ranked as highly sensitive. This is an area where Pleistocene deposits could be present, and which, in addition, contains the historic Denver and Rio Grande Western Railroad, which may be eligible for listing on the National Register. The sensitivity of each of the proposed routes is summarized below.

Alternatives A and B - Because the existing pipeline route is already disturbed, we judge it to be of no sensitivity from a cultural resources perspective.

Alternative C - Burnout Canyon Routes (1) and (2) - The Burnout Canyon route would contain a 2.1-mile stretch of moderate sensitivity because of the possibility that Upper Huntington Canyon may contain buried, undetected Pleistocene faunal remains.

Alternative C - Burnout Canyon Routes (3) and (4) - Both of these routes would contain 0.3 mile assigned a moderate sensitivity because of potential, undetected Pleistocene remains along Upper Huntington Canyon. Each route would also contain 0.4 mile of low sensitivity where Segment 24 would deviate from the Utah Highway 264 right-of-way, and therefore has not been assessed for potential cultural resources (the Utah Highway 264 right-of-way has been assessed and determined not to require cultural resources inventory (Wikle 1982)).

Alternative D - Gooseberry Route - Two stretches along the Gooseberry Route (totaling 0.7 mile) are assigned moderate sensitivity because of their potential to contain buried, undetected Pleistocene vertebrate remains. These involve the area where Segment 1 would cross Gooseberry Creek, and the stretch along Upper Huntington Canyon (on Segments 2 and 3). The Gooseberry Route also would contain 2.2 miles of low sensitivity on private land, which has not been surveyed. Based on previous findings, we predict that few, if any, important cultural resources would be found in this area.

Valley Camp Triangle Connectors (1) through (3) - All limits of segments of the Valley Camp Triangle have been intensively surveyed and no cultural resources were encountered. Therefore, we judge it to be of no sensitivity from a cultural resource perspective.

Alternative E - Winter Quarters Routes (1) and (2) - The Winter Quarters route would contain areas of high, moderate, and low sensitivity. If Winter Quarters Route (2) is used, 5.1 miles of unsurveyed, low sensitivity area, 1.3 miles of moderate sensitivity possibly containing historic resources as well as possible buried, undetected Pleistocene fauna, and 1.8 miles of high sensitivity would be crossed. The high sensitivity is the result of potential Pleistocene fauna as well as the confirmed presence of a historic railroad north of Clear Creek. The moderate sensitivity areas are just south of Scofield and near the intersection of the old Price Road with the Scofield Road.

If Winter Quarters Route (1) is used instead, all high sensitivity areas will be avoided, and 6.5 miles of unsurveyed low sensitivity would be involved along with 0.9 mile of moderate sensitivity--south of Scofield where both buried, undetected Pleistocene remains and historic resources could be present, and along the historic Price Road.

Direct adverse physical impacts to cultural resources could occur during ground disturbing activities associated with construction, such as vegetation removal, excavation of the pipeline trench, and preparation and use of temporary yards for equipment and materials storage. Indirect adverse impacts could result after construction due to improved access which makes archaeological sites more vulnerable to accidental or deliberate disturbance. Physical disturbance of a site, whether it is direct or indirect, causes a permanent loss of information. Archaeologists study the spatial patterning of artifacts and features within sites; once this pattern has been disrupted, it can never be reconstructed.

Specific Descriptions

The purpose of the impact assessment is to predict relative impacts of the proposed routes. Physical ground disturbance along any given stretch will be very similar given the nature of the project. Therefore, predicted impact levels mirror sensitivity rankings. In rating the severity of impacts, the relative probability of high, moderate and low impacts is assessed.

The results of the impact assessment are tabulated on a segment-by-segment basis in Table 4-7. Because all proposed routes pass through areas of at least moderate sensitivity, it is possible that impacts to cultural resources will not be able to be avoided entirely irrespective of the final route selection. However, the project will be done in compliance with regulations for "Protection of Historic Properties" (36 CFR 800) issued by the Advisory Council on Historic Preservation to implement Section 106 of the National Historic Preservation Act. This will ensure that prudent and feasible measures to avoid or reduce any identified adverse impacts are designed and carried out. The Forest has initiated consultation with the Utah State Historic Preservation Officer for this purpose.

Alternatives A and B - No impacts to important cultural resources are predicted along the existing route. If a redundant pipeline is constructed it is assumed that the effects from construction of the redundant line would be confined to the existing pipeline right-of-way. Although this alignment has not been entirely inventoried, we assume that any cultural resources that might originally have been present along it would have lost their integrity as the result of disturbance caused by initial pipeline installation. It is, of course, possible that subsidence associated with the partial mining option could effect resources beyond the existing right-of-way, but these would be the result of a different action. If temporary storage yards beyond the right-of-way were required as part of this option, they would need to be surveyed to ensure that important cultural resources were identified, evaluated, and properly treated.

Alternative C - Burnout Canyon Routes - Burnout Canyon Routes (1) or (2) could result in 2.1 miles of moderate potential impact related to the possibility of encountering Pleistocene faunal remains. Burnout Canyon Routes (3) or (4) could result in 0.3 mile of moderate potential impact also related to the possibility of encountering Pleistocene faunal remains, as well as 0.4 mile of potential low impact along unsurveyed stretches of Segment 24 where the proposed construction right-of-way deviates from the Highway 264 right-of-way.

Alternative D - Gooseberry Route - This route contains 2.2 miles evaluated as being subject to low potential impact along an unsurveyed stretch of private land on Segment 1 and 0.7 mile of moderate potential impacts because of the possible, undetected, buried Pleistocene faunal remains. No high impacts are anticipated.

Valley Camp Triangle Connectors (1) through (3) - No impacts to cultural resources are predicted along the segments within the Valley Camp Triangle because each has been intensively surveyed and no cultural resources were found.

Alternative E - Winter Quarters Routes - Winter Quarters Route (1) would have 6.5 miles of unsurveyed low potential impact, and 0.9 mile of moderate potential impact. Winter Quarters Route (2) contains 5.1 miles of unsurveyed low potential impact, 1.3 miles of moderate potential impact related both to possible historic resources and Pleistocene fauna, and 1.8 miles of high potential impact posed by the presence of an extant historic railroad in combination with possible Pleistocene faunal presence. Unsurveyed areas located on private lands will need to be surveyed if this route is selected. Appropriate measures for evaluating and treating important cultural resources would then need to be implemented.

TABLE 4-7
SUMMARY OF POTENTIAL IMPACTS: CULTURAL AND PALEONTOLOGICAL RESOURCES
(Miles Crossed)

ROUTE	TOTAL MILES	HIGH	MODERATE	LOW	NO IDENTIFIABLE	COMMENTS
Alternative A No-Action	13.5	-	-	-	13.5	no disturbance, unsurveyed
Alternative B						
Leave in place, Full extraction mining	13.5	-	-	-	13.5	no disturbance, unsurveyed
Alternative C						
Burnout Canyon (1)	14.9	-	2.1	-	12.8	segments surveyed, no cultural resources located; moderate potential for buried Pleistocene vertebrate remains
Burnout Canyon (2)	15.1	-	2.1	-	13.0	segments surveyed, no cultural resources located; moderate potential for buried Pleistocene vertebrate remains
Burnout Canyon (3)	15.1	-	0.3	0.4	14.4	possible buried Pleistocene vertebrate remains; unsurveyed
Burnout Canyon (4)	15.3	-	0.3	0.4	14.6	possible buried Pleistocene vertebrate remains; unsurveyed
Alternative D						
Gooseberry Canyon	16.7	-	0.7	2.2	13.8	possible buried Pleistocene vertebrate remains
Valley Camp Triangle Connectors						
(1)	1.0	-	-	-	1.0	survey complete; no cultural resources
(2)	0.9	-	-	-	0.9	survey complete; no cultural resources
(3)	0.5	-	-	-	0.5	survey complete; no cultural resources
Alternative E						
Winter Quarters (1)	16.1	-	0.9	6.5	8.7	possible buried Pleistocene vertebrate remains;
(with Segments 19* & 23*)	20.2	-	0.9	6.5	12.8	sites associated with railroad system; other possible historic sites; unsurveyed
Winter Quarters (2)	17.2	1.8	1.3	5.1	9.0	possible buried Pleistocene vertebrate remains;
(with Segment 19*)	20.0	1.8	1.3	5.1	11.8	sites associated with railroad system; other possible historic sites; unsurveyed

Paleontology

The Utah Division of State History provided descriptions of sensitivity levels by which to assess the potential impacts to potentially undetected paleontological resources in the study area. The sensitivity levels provided include critical and significant (high impact), important (moderate impact), and insignificant and unimportant (low impact). Within the study area, most fossils are plentiful, relatively common, and considered insignificant to important. However, significant finds of dinosaur bones and mammoth and mastodon remains have been found in valley-bottom areas and sinkholes on the Wasatch Plateau.

The probability of finding important or significant fossil remains is considered low. However, the construction crew would be made aware of the possibility of finding fossils in the geologic formations and prehistoric mammal remains in the low valley bottoms along Gooseberry Creek and Upper Huntington Creek and sinkholes in the North Horn Formation and the Flagstaff Limestone.

Specific Descriptions - Alternatives where there is a potential for moderate impacts associated with possible locations of buried Pleistocene fauna (potentially indicative of human habitation prehistorically) are described under Cultural Resources and in Table 4-7. All other areas are considered to have low potential impacts.

TABLE 4-7
SUMMARY OF POTENTIAL IMPACTS: CULTURAL AND PALEONTOLOGICAL RESOURCES
(Miles Crossed)

ROUTE	TOTAL MILES	HIGH	MODERATE	LOW	NO IDENTIFIABLE	COMMENTS
Alternative A No-Action	13.5	-	-	-	13.5	no disturbance, unsurveyed
Alternative B Leave in place, Full extraction mining	13.5	-	-	-	13.5	no disturbance, unsurveyed
Alternative C						
Burnout Canyon (1)	14.9	-	2.1	-	12.8	segments surveyed, no cultural resources located; moderate potential for buried Pleistocene vertebrate remains
Burnout Canyon (2)	15.1	-	2.1	-	13.0	segments surveyed, no cultural resources located; moderate potential for buried Pleistocene vertebrate remains
Burnout Canyon (3)	15.1	-	0.3	0.4	14.4	possible buried Pleistocene vertebrate remains; unsurveyed
Burnout Canyon (4)	15.3	-	0.3	0.4	14.6	possible buried Pleistocene vertebrate remains; unsurveyed
Alternative D						
Gooseberry Canyon	16.7	-	0.7	2.2	13.8	possible buried Pleistocene vertebrate remains
Valley Camp Triangle Connectors						
(1)	1.0	-	-	-	1.0	survey complete; no cultural resources
(2)	0.9	-	-	-	0.9	survey complete; no cultural resources
(3)	0.5	-	-	-	0.5	survey complete; no cultural resources
Alternative E						
Winter Quarters (1)	16.1	-	0.9	6.5	8.7	possible buried Pleistocene vertebrate remains; sites associated with railroad system; other possible historic sites; unsurveyed
(with Segments 19* & 23*)	20.2	-	0.9	6.5	12.8	
Winter Quarters (2)	17.2	1.8	1.3	5.1	9.0	possible buried Pleistocene vertebrate remains; sites associated with railroad system; other possible historic sites; unsurveyed
(with Segment 19*)	20.0	1.8	1.3	5.1	11.8	

CHAPTER 7 - REFERENCES

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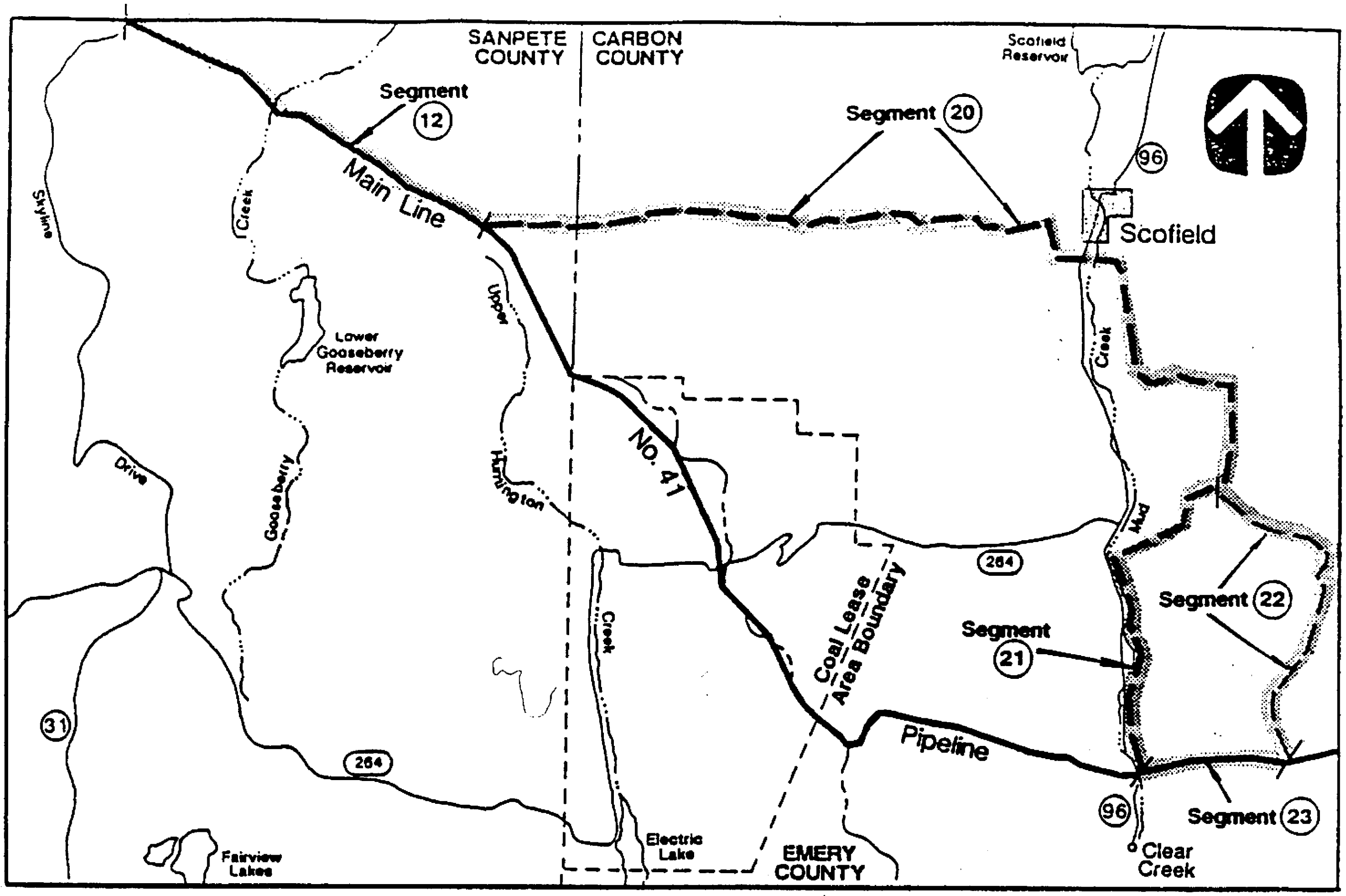


FIGURE B-4. THE WINTER QUARTERS ROUTE

Segments 12*, 20, 21, 23*; variation Segment 22; associated Segment 19*

Segment 12* (3.7 miles in length) is part of the existing pipeline and for purpose of this study begins in the northwest quarter of Section 25, T.12 S., R.5 E. (SLM) at the headward side of the Cabin Hollow Creek Drainage. The pipeline trends southeasterly from near the junction of Skyline Drive and an unimproved two-track road, the latter of which runs adjacent to the pipeline for one-half mile before turning south. One-third mile thereafter, the pipeline begins descending some 1,000 feet in elevation over the next mile to the crossing at Gooseberry Creek, then ascends nearly 1,400 feet over the remaining 2.2 miles.

An unimproved two-track road roughly parallels the pipeline for some 2.6 miles beginning about 0.4 mile west of the Gooseberry Creek crossing to the eastern end of Segment 12*. The roadway crosses the pipeline at numerous locations along the segment.

Segment 20 (9.1 miles in length) trends east/west for approximately two-thirds of its proposed length along the upland reaches of Winter Quarters Ridge before descending just west of Scofield to crossings situated at an unimproved two-track road, Winter Quarters Creek and Mud Creek. After skirting the southern corporate limits of Scofield, the segment turns southward just east of Mud Creek atop the ridgeline separating Pleasant Valley on the west and UP Canyon to the east for the distance of 1.1 miles. At

that point, the proposed segment turns east for .75 mile and then south for the remaining distance.

An unimproved two-track road would run adjacent to the proposed pipeline segment from the vicinity of Scofield to the junction with either Segment 21 or 22.

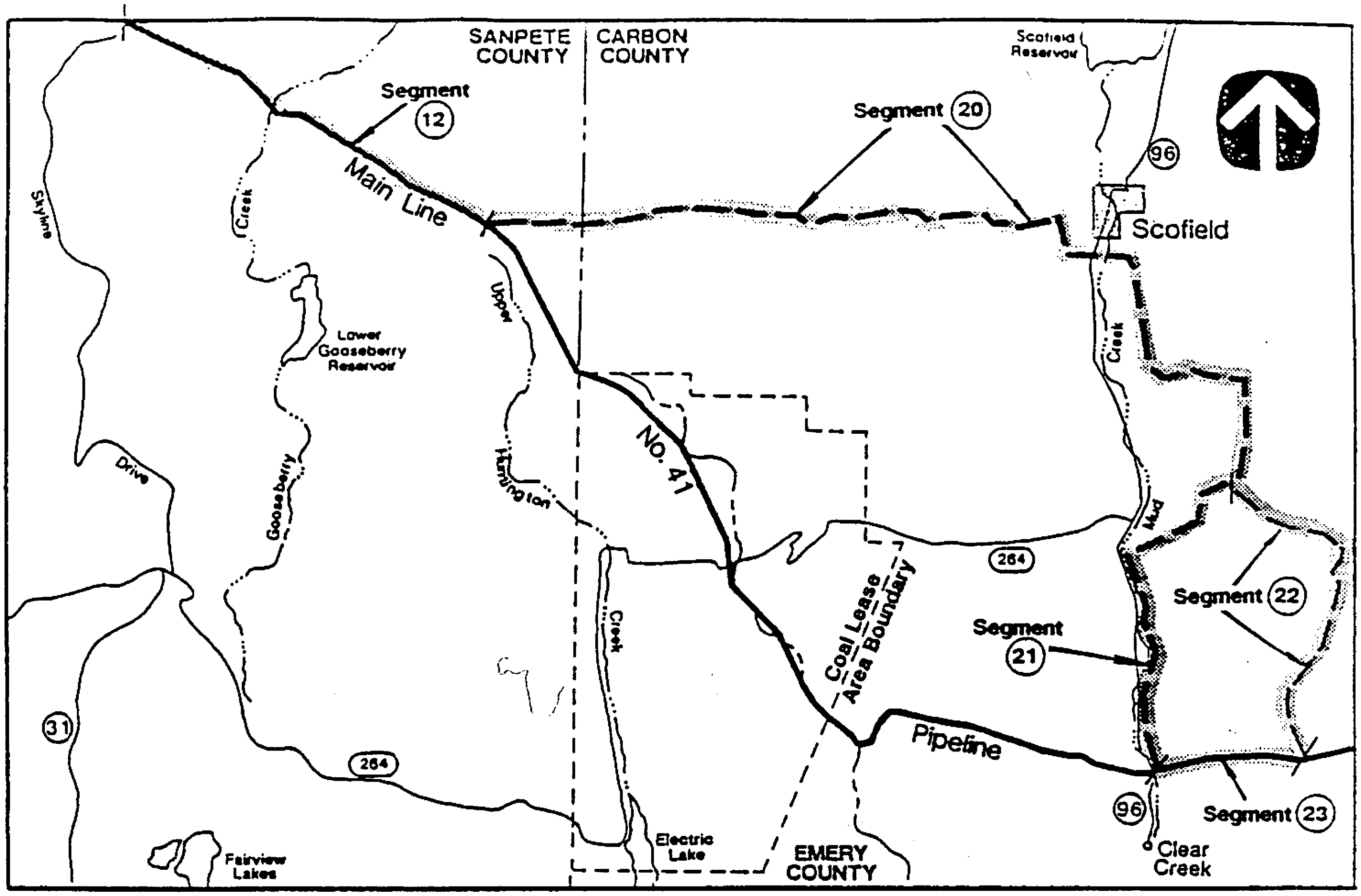
Segment 21 (3.1 miles in length) descends the ridgeline north of Broads Canyon crossing along its course 2 unimproved roads and the stream at the mouth of Broads Canyon before reaching and crossing Mud Creek. The proposed pipeline segment then runs upstream adjacent to and west of Mud Creek until the mouth of Slaughter House Canyon where the pipeline crosses to the east side of the creek near an existing highway culvert. The segment then continues upstream to connect with the existing pipeline just east of Utah State Highway 96.

Segment 23* (1.3 miles in length), part of the existing pipeline, differs in elevation by over 1,200 feet between the western end (lowest) and eastern end (highest) of the segment. The pipeline follows the ridgeline between Boneyard Canyon on the north and Magazine Canyon to the south and continues eastward to a topographic feature referred to as "The Elbow". This location marks the eastern extent of the proposed pipeline reroute project and is situated in the southwestern quarter of Section 27, T.13 S., R.7 E. (SLM).

Segment 22 (3.3 miles in length) is an eastern alternative for the Winter Quarters Route. The proposed segment instead of descending along the ridgeline of Broads Canyon like Segment 21, sidles eastward and southward along the upper reaches of Broads Canyon before rejoining the existing pipeline at "The Elbow". Unimproved two-track roads exist adjacent to the proposed pipeline alignment.

Segment 19* (2.8 miles of existing pipeline) is not a part of either Winter Quarters Routes (1) or (2). However, if either of these routes is selected, the existing pipeline of Segment 19* cannot be abandoned as it is needed to supply gas to a tap line that joins Main Line No. 41 at the western terminus of Segment 19*. Because this segment cannot be abandoned, the environmental resources are addressed along Segment 19* not as part of the routes, but as a segment associated with the route.

The first one-half mile on the western end of Segment 19* trends northeasterly before turning in a southeasterly direction. The southeastern component follows the ridgeline between Slaughter House Canyon on the north and Boardinghouse Canyon to the south and crosses and runs parallel to a unimproved road for nearly 0.5 mile at the western end of the component. At the eastern end of the segment, the topography descends nearly 1,100 feet over the last 0.5 mile, crossing State Highway 96 and Mud Creek near the junction with Segment 23*.



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APPENDIX G

AIR QUALITY

AIR QUALITY
APPENDICES

APPENDIX G
AIR QUALITY

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CLIMATOLOGY AND AIR QUALITY
UCO, INC, 1982

GROUND COAL MINING PERMIT APPLICATION

SCOFIELD MINE

CARBON COUNTY, UTAH

UCO, Inc.
7355 E. Orchard Rd.
Suite 100
Englewood, Colorado 80111

September, 1982

CHAPTER X

CLIMATOLOGY AND AIR QUALITY

AIR QUALITY AND CLIMATOLOGY SURVEY

SCOFIELD MINE

CARBON COUNTY, UTAH

PREPARED FOR:

UCO, INC.
1580 Lincoln, Suite 530
Denver, Colorado 80203

PREPARED BY:

Beak Consultants Incorporated
3033 South Parker Road, Suite 702
Aurora, Colorado 80014

December 30, 1981

William R. Monnett
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Division Manager

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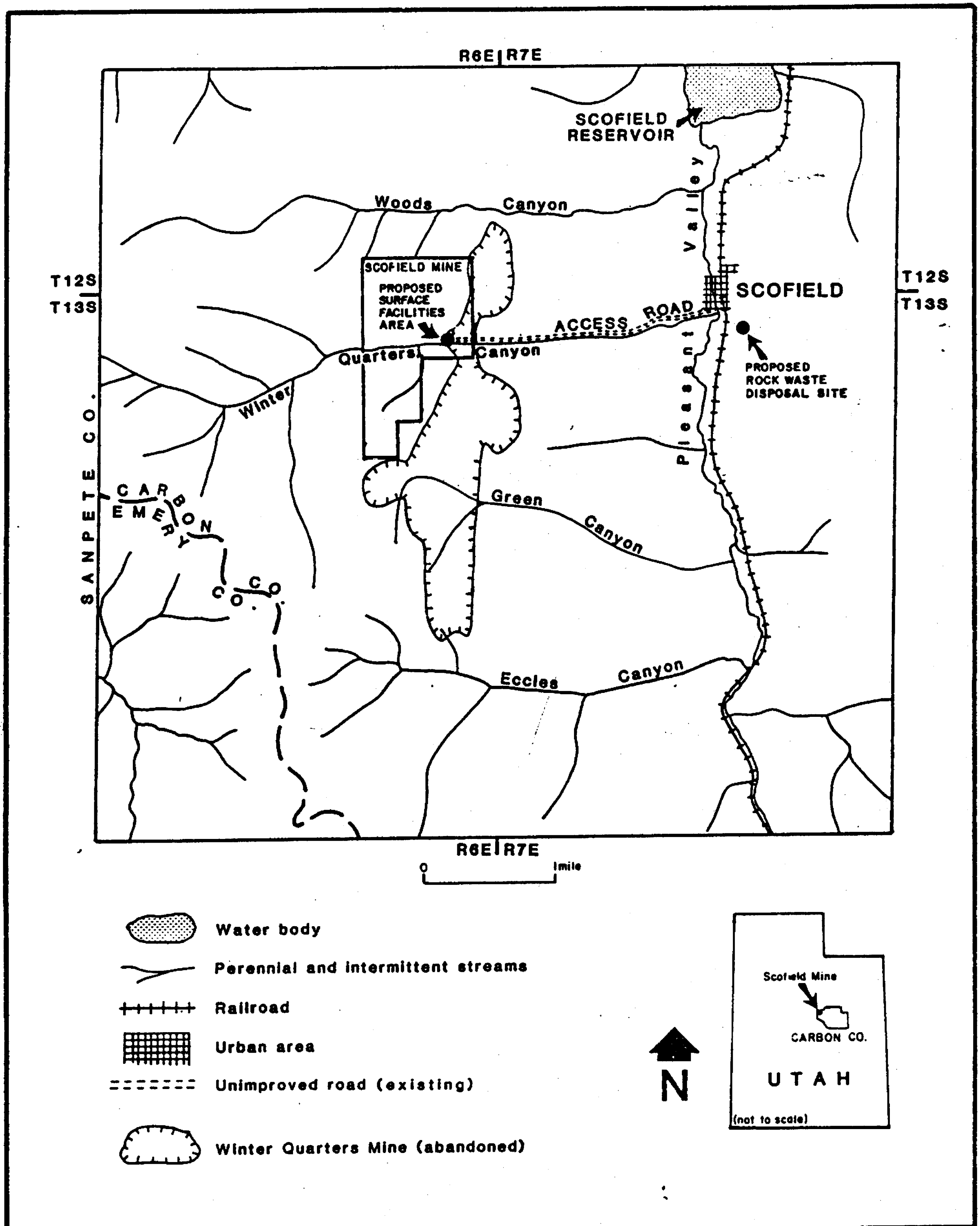
1.0 Introduction

The purpose of this report is to supply technical information related to atmospheric emissions of fugitive dust associated with the proposed development of UCO, Inc.'s Scofield Mine and surface facilities. Beak Consultants Incorporated has been retained by UCO to prepare this document in support of their formal Notice of Intent to construct and operate said facility. This document is to be submitted to the Utah State Department of Health, Bureau of Air Quality and the Utah State Department of Natural Resources, Division of Oil, Gas, and Mining to enable a complete and successful review of proposed facility so that an Approval Order may be issued at the earliest possible date.

The proposed mine is located in Carbon County, Utah near the town of Scofield (Figure 1-1). Surface facilities for the underground coal mine will be located in Winter Quarters Canyon, approximately two miles west of Scofield. The mine will be designed to produce a maximum of 700,000 tons per year of low sulfur coal. Surface facilities will include a primary crusher, scalping screen, loadout silo, associated conveyors, transfer towers, and auxiliary facilities.

In this report, BEAK has described those mining operations which lead to fugitive dust emissions, quantified their uncontrolled emissions, described their proposed mitigation and control measures, and quantified their ultimate controlled emission rates in Section 2.0. Emissions have been estimated through the application of the best available emission factors for mining operations. Section 3.0 describes the existing climate of the project location relying on regional and nearby data sources. Section 4.0 presents an assessment of the anticipated ambient air quality impacts to be associated with the facility.



SCOFIELD MINE PROJECT AREA

FIGURE 1

2.0 Project Description and Emission Inventory

UCO's preliminary design for an underground mine and associated surface facilities and truck loadout are capable of handling over 700,000 tons per year of run-of-mine coal on their property near Scofield, Utah. Figure 2-1 shows the location of the mining and coal handling facilities with respect to topographic features. The mine portals are presently planned to be located along the south side of Winter Quarters Canyon near the valley floor. Coal handling facilities will be located on a bench along the north side of the canyon. Silo-loaded coal will be shipped by haul truck. Conceptual engineering drawings are presented in Appendix A and Chapter III, Operation and Reclamation Plan.

Following is a more detailed description of the transfer and processing operations planned for the mine. Each process is then evaluated for its contribution of uncontrolled particulates.

2.1 Uncontrolled Emissions

Run of mine coal will be transferred from the mine on a 42 inch slope belt to a transfer tower. From this tower, the coal will be conveyed to a second transfer tower where it will either be processed through a primary crusher or conveyed to an emergency stockpile. Stockpiled coal will eventually be reclaimed with a rubber-tired dozer and belt feeder back to the transfer tower. Approximately 70,000 tons of coal will be moved annually through the emergency stockpile; it will cover less than one-half acre. From the crusher, coal will be conveyed to a 4,000 ton silo where it will be flood loaded into 40 ton haul trucks.

Primary Crushing

The emission factor for primary crushing comes directly from US Environmental Protection Agency's (EPA) Region VIII policy paper of 10 December 1979 on air quality analysis for mining operations. This factor shows that uncontrolled emissions are directly proportional to the production or throughput rate. Uncontrolled annual emissions are therefore;

$$E_u = \frac{FP}{K} \text{, where;}$$

F = Emission factor (0.02 lb/ton of coal crushed)

P = Annual production rate (700,000 tons)

K = Conversion factor (1 ton = 2,000 lbs) therefore;

$$E_u = \frac{(0.02 \text{ lb/ton})\ (700{,}000 \text{ tons/yr})}{(2{,}000 \text{ lb/ton})}$$

$$= 7.0 \text{ tons/yr}$$

Conveyors and Transfer Points

The emission factor for conveyors and transfer houses used here is also excerpted from EPA, 1979. EPA recommends that a single factor of 0.2 lb/ton be used to account for all conveyor sections and transfer towers regardless of their lengths or numbers. Again, the total uncontrolled emission rate is directly proportional to the throughput. Therefore;

$$E_u = \frac{FP}{K} \text{, where;}$$

F = Emission factor (0.2 lb/ton)

P = Annual throughput (700,000 tons/year), and

K = Conversion factor, therefore;

$$E_u = \frac{(0.2\ \text{lb/ton})\ (700{,}000\ \text{tons/yr})}{(2{,}000\ \text{lb/ton})}$$

$$= 70.0\ \text{tons/yr}$$

Stockpile Emissions

Total emissions from stockpiles can be attributed to four individual activities which release dust to the air: loadin to the pile, loadout of the pile, wind erosion of the pile, and pile maintenance. The following emission factors are attributed to each activity by Cowherd and Hendricks (1978). These factors are also used by the Colorado Department of Health to characterize stockpile emissions.

Stockpile loadin	0.04 lb/ton
Stockpile loadout	0.05 lb/ton
Wind erosion	0.018 lb/ton
Stockpile maintenance	0.02 lb/ton
Total	0.128 lb/ton

Therefore, uncontrolled emissions resulting from the emergency stockpile which has an estimated annual throughput of 70,000 tons is;

$$E_u = \frac{FP}{K}, \text{ where,}$$

F = Emission factor (0.128 lb/ton)

P = Throughput on pile (70,000 ton/yr)

K = Conversion factor

$$E_u = \frac{(0.128\ \text{lb/ton})\ (70{,}000\ \text{ton/yr})}{(2{,}000\ \text{lb/ton})}$$

$$= 4.5\ \text{tons/yr}$$

Exposed Area Wind Erosion

The emission factor for bare area wind erosion is a complex function of a number of climatological and surface characteristic variables. Those variables taken into account by Cowherd and Hendricks (1978) are the surface erodibility (tons/acre-yr), silt content (%), the percentage of wind speeds over a base value which induces erosion, and the Thornthwaite precipitation/evaporation index.

It is estimated that up to seven acres of the mine site will be disturbed and unclaimed at any point in time during operation. Therefore, emissions from exposed areas are given as:

$$F = \frac{3400\left(\frac{e}{50}\right)\left(\frac{s}{15}\right)\left(\frac{f}{25}\right)}{\left(\frac{PE}{50}\right)^2} \text{ in lb/acre/yr, where,}$$

e = Surface erodibility (estimated at 10 ton/acre-yr by UCO soils scientists)

s = Silt content of surface (10% estimated by soils scientists)

f = % of time wind speed exceeds 12 mph (30% conservative estimate taken from Boardinghouse Peak data)

PE = 51 (indicative of central Utah highlands), therefore;

$$F = \frac{3400\left(\frac{10}{50}\right)\left(\frac{10}{15}\right)\left(\frac{30}{25}\right)}{\left(\frac{51}{50}\right)^2} = 523 \text{ lb/acre/yr, and}$$

$$E_u = \frac{(523 \text{ lb/acre/yr})\ (7 \text{ acres})}{(2{,}000 \text{ lb/ton})}$$

$$= 1.8 \text{ tons/yr}$$

Haul Road Emissions

Crushed coal will be loaded into 40 ton highway trucks via a silo loadout system. The coal will then be transported from the property via an improved haul road which leads two miles down Winter Quarters Canyon into Scofield.

The emission factor for haul roads (EPA 1975) is dependent on the vehicle speed, tire size, silt content of the road bed, and percentage of dry days per year.

$$F = 0.81\ H_v\ T_s\ s\left(\frac{S}{30}\right)^2 \left(\frac{365-W}{365}\right) \text{ where;}$$

H_v = Fraction of particles <30μ in diameter (0.6)

T_s = Tire size correction factor for large haul trucks (2.5)

s = Assumed silt content (percent) of roadbed material (10)

S = Average vehicle speed in miles per hour. A 20 mph speed limit will be imposed on the haul road

W = A climatic factor which represents the mean number of days/yr with 0.01 inch or more of precipitation (90)

Therefore, the emission factor is:

$$F = (0.81)\ (0.6)\ (2.5)\ (10) \left(\frac{20}{30}\right)^2 \left(\frac{365-90}{365}\right)$$

$$= 4.07 \text{ lb/veh-mi}$$

To derive the number of miles traveled one must know the production rate, the average capacity of each truck and the round-trip distance. Hence,

P = Coal production rate (700,000 tons/yr)

T_c = Average truck capacity (40 tons)

D = Round trip haul distance (4.0 miles), Therefore, the uncontrolled emissions from haul roads are:

$$E_u = \frac{(4.07 \text{ lb/veh-mi})\ (700,000 \text{ tons/yr})\ (4.0 \text{ miles})}{(40 \text{ tons/truck})\ (2,000 \text{ lb/ton})}$$

$$= 142.5 \text{ tons/yr}$$

It should be noted that while this figure does not reflect improvements to the roadbed to mitigate dust, it does reflect a 56 percent control factor due to the reduction of haul truck speeds to 20 from 30 miles per hour.

Miscellaneous Vehicular Emissions

To account for miscellaneous vehicular emissions into and about the mine site other than the coal hauling traffic, an attempt was made to quantify the number of trips into the facility based on the projected work force.

At maximum production, UCO will employ about 110 people at the Scofield Mine. Although buses or van pooling will be used to transport the work force to and from the mine, a conservative estimate of one vehicle per three workers was used to estimate vehicle miles traveled.

The emission factor for fleet vehicles traveling on unpaved roads is 2.5 times less than that for large haul trucks. This decrease is reflected in the fact that fleet vehicles have much smaller tires and the 2.5 correction factor for large tires is not necessary in calculating the factor. The emission factor for fleet vehicles is then:

$$F = (0.6)\ (0.8)\ (10)\left(\frac{20}{30}\right)^2\left(\frac{365-90}{365}\right) = 1.63\ \text{lb/veh-mi}$$

The total uncontrolled emissions are therefore:

$$E_u = \frac{FND}{K}, \text{ where;}$$

F = Emission factor (1.63 lb/veh-mi)

N = Number of trips annually (37 trips/day and 240 days/yr)

D = Round trip travel distance (4.0 miles)

K = Conversion factor, therefore;

$$E_u = \frac{(1.63 \text{ lb/veh-mi}) (8880 \text{ trips}) (4.0 \text{ miles/trip})}{(2,000 \text{ lb/ton})}$$

$$= 28.9 \text{ tons/yr}$$

Silo Loadout to Trucks

Haul trucks will be loaded from the 4,000 ton silo by a flood gate loading system. The uncontrolled emission rate is proportional to the amount of coal loaded according to the EPA approved (EPA 1979) emission factor. Therefore;

$$E_u = \frac{FP}{K}, \text{ where;}$$

F = Emission factor (0.0002 lb/ton)

P = Production rate

K = Conversion factor, therefore;

$$E = \frac{(0.0002 \text{ lb/ton}) (700,000 \text{ tons/yr})}{(2,000 \text{ lb/ton})}$$

$$= 0.1 \text{ tons/yr}$$

A summary of uncontrolled emissions is presented in Table 2-1. Particulate matter is the only pollutant that will be emitted in significant amounts. Tailpipe emissions of gaseous pollutants will be negligible.

2.2 Controls and Mitigation Measures

UCO will take extensive measures to control dust emissions from the Scofield Mine Project. UCO will make every effort to incorporate both mine design and best management practices to minimize operations-related fugitive particulate emissions. The following mitigating measures are therefore proposed to meet the requirements of Section IV, Subpart 5.4 of the Utah Department of Health, Air Conservation Regulations.

UNCONTROLLED EMISSIONS SUMMARY

TABLE 2-1

Operations	Uncontrolled Emissions (Tons/yr)
Primary Crushing	7.0
Conveyors and Transfer Points	70.0
Stockpile Emissions	4.5
Exposed Area Wind Erosion	1.8
Haul Road Emissions	142.5
Miscellaneous Vehicular Emissions	28.9
Silo Loadout to Trucks	0.1

Primary Crusher

Spray bars will be employed on the surge bin prior to screening and crushing, and transfer stations. An anti-freeze agent will be added to the water during the cold weather months to prevent system freeze-up. The direct spray of water at the crusher plus the carryover moisture from spraying at the top and the bottom of the first transfer tower will provide for at least 50 percent control on these emissions.

While this system does not explicitly follow EPA guidelines with respect to Best Available Control Technology for crusher systems the mine is not a major source. Furthermore, UCO does not believe that the small additional increase in emission reductions from a baghouse system (approximately 3.4 tons/year) warrants the economic hardships associated with the capital and maintenance costs associated with the baghouse system.

Conveyors and Transfer Points

All conveyors will be partially enclosed (180° cover with bottom pan) and both transfer towers will be equipped with spray bar systems. Since emissions from these operations are lumped under one emission factor, a composite control efficiency was selected for the total operation. The conveyor systems are allowed a 90 percent control efficiency due to their partial covering and protection from wind erosion. The water spray systems will achieve 50 percent control at the transfer houses. Therefore, if one assumes that each process is responsible for an equal amount of the total emission load (for lack of information to the contrary), then a composite 70 percent control efficiency may be applied to this emission category.

Silo Loadout

Haul trucks will be loaded by a flood type loadout system with a retractable chute to mitigate emissions. A spray bar system will be installed at the bottom of the silo to treat coal passing through the hydraulic slide gate. A 95 percent control efficiency is achieved by implementing these controls.

Miscellaneous Vehicular Emissions

These emissions will be controlled with magnesium chloride compound and by reducing speed limits to those for large haul truck traffic.

Stockpile Emissions

Emissions from the coal stockpile will be mitigated by minimizing the amount of coal delivered to the pile, by minimizing the fall distance from conveyor to pile, and by minimizing the surface area of the pile exposed to erosion. No control efficiency has been claimed in the controlled inventory for these practices.

Exposed Area Wind Erosion

Wind erosion will be held to a minimum by timely reclamation practices to enhance rapid revegetation of exposed areas. Mulching, surface conditioning and contouring will also be undertaken to minimize topsoil erosion. No emissions reductions have been claimed for these practices.

Haul Road Emissions

Two measures will be undertaken to minimize dust emissions from haul road traffic. First, UCO will apply a magnesium chloride compound to the road-bed on an as needed basis. Second, all haul road traffic will be limited to a maximum speed of 20 mph. Each measure should reduce uncontrolled emissions by 85 and 56 percent, respectively, although the speed limit has already been taken into account in the uncontrolled emission factor. Thus, an additional 85 percent control should be realized through the application of magnesium chloride.

Estimated Control Costs of the Spray Bar System

It is estimated that a solution flow rate of 12.5 gallons per minute is required for adequate control. The material cost of the spray bar system is approximately $52,000.

2.3 Controlled Emissions

Following are calculations for each operation showing the changes in controlled versus uncontrolled emissions upon employment of the control measures described in the previous section.

Primary Crushing

E_u = 7.0 tons/yr

E_c = 7.0 (1-0.50)

= 3.5 tons/yr

Conveyors and Transfer Points

E_u = 70.0 tons/yr

E_c = 70.0 (1-0.70)

= 21.0 tons/yr

Stockpile Emissions

No control efficiency claimed

$E_c = E_u$

$= 4.5$ tons/yr

Exposed Area Wind Erosion

No control efficiency claimed

$E_c = E_u$

$= 1.8$ tons/yr

Haul Road Emissions

$E_u = 142.5$ tons/yr

$E_c = 142.5\ (1-0.85)$

$= 21.4$ tons/yr

Miscellaneous Vehicular Emissions

$E_u = 28.9$ tons

$E_c = 28.9\ (1-0.85)$

$= 4.3$ tons/yr

Silo Emissions

$E_u = 0.1$ tons/yr

$E_c = 0.1\ (1-0.95)$

= negligible

Controlled emissions from the facility will total less than 100 tons. (Table 2-2). Therefore, pursuant to Bureau of Air Quality quidelines, UCO is not required to present an impact assessment of facility emissions. However, due to the valley location of the source and its proximity to the town of Scofield, UCO has prepared an impact assessment to demonstrate that all impacts will be well within the limits set by the National Ambient Air Quality Standards (NAAQS). This assessment is presented in section 4.0.

CONTROLLED EMISSIONS SUMMARY

TABLE 2-2

Operation	Controlled Emissions (Tons/yr)	Control Technique
Primary Crushing	3.5	Spray bars.
Conveyors and Transfer Points	21.0	Partially enclosed conveyors and completely enclosed transfer points with spray bar system.
Stockpile Emissions	4.5	Minimize the impact and exposed acreage.
Exposed Area Wind Erosion	1.8	Best reclamation practices.
Haul Road Emissions	21.4	Magnesium chloride applied as needed to road surface, limit truck speeds to 20 mph.
Miscellaneous Vehicular	4.3	Same as haul road.
Silo Emissions	Negligible	Retractable chute and spray bar system.
Total	56.5 tons/yr	

3.0 Climatology and Meteorology

Climatic information is not available from the UCO site but data collected by other mining ventures in the proximate area and data collected at three National Weather Service Stations were used to develop a reasonable climatic profile for the site. BEAK has reviewed information collected by Coastal States Energy for the Skyline Mine Project at their Boardinghouse Peak and Eccles Canyon stations and National Weather Service data from Emery, Manti and Price for this purpose.

The climate in the project area can be classified as subalpine, although local micro-climates are strongly influenced by elevation and topography. The region characteristically has long cold winters and brief summers. Temperature extremes range from -40° F for wintertime lows to near 90° F for summertime highs. Precipitation is moderate at high altitudes, decreasing eastward from the Wasatch Plateau as elevations decrease.

Precipitation

Precipitation in the mine area is moderate, averaging approximately 28 inches annually. The majority of this precipitation falls as snow from October through May. During the summer, intermittent thunderstorms can account for up to eight inches of the total precipitation received annually. A review of precipitation data collected at Manti, 40 miles southwest of the mine site, shows that the mean maximum precipitation is 1.45 inches in March. The mean minimum is 0.75 inches in July. Manti, however, receives only 12.99 inches of precipitation annually which reflects in its lower altitude as compared to the mine site. The variability in climatic variables due to elevation (5,500 vs 8,400 feet) can clearly be seen here and at Price as well where the annual average is but 9.77 inches.

In the higher elevations, snow accumulation averages four to five feet with maximum expected accumulation near nine feet in late winter. Major snowfalls generally occur in February and March. Typical snowfall rates for the area are from two to eight inches per 24-hour period, but snowfalls in excess of one foot per 24 hours occur occasionally.

Temperature

Due to its high elevation and exposure to typically dry continental air masses, the project location should exhibit large diurnal and annual temperature variations. Although site specific data are not available, local data sources indicate the average monthly temperatures vary from a minimum of -1° F in January to a maximum of 63° F in July. In Manti, the average diurnal variation is 30° F for a mean maximum of 62° F and a mean minimum of 32° F.

Evaporation and Relative Humidity

The potential evapotranspiration for the area is about 18 inches per year. This rate is at a maximum during summer months when precipitation is at a minimum and temperature is at a maximum.

A review of data sources did not find relative humidity information for the immediate area, however, the other climatic variables and the high elevation intuitively indicate that annual average relative humidities should be very low.

Winds

Local micro and mesoscale winds are again strongly influenced by the topography of the region. In general, winds in the valleys are much lighter than those at high altitude, exposed locations. Valley winds also show a pronounced axial bias in wind direction due to both density driven up and downslope diurnal flows and also as a result of localized channelling of the synoptic scale winds found aloft.

Data collected over an eight month period by Coastal States Energy in Eccles Canyon (2.5 miles south of the project site) indicate that wind speeds within the canyon are very low, averaging less than seven miles per hour. Eccles Canyon is very similar in directional orientation and topographic configuration to Winters Quarters, therefore, it is reasonable to believe that winds will behave in a similar manner. Boundary layer studies in this canyon also indicate, as expected, that wind speeds increase with height above the valley floor.

On the nearby plateaus, average wind speeds are much stronger, averaging about 15 miles per hour, as indicated by Coastal States' Boardinghouse Peak Station (four miles south of project site and located at 9,943 feet). The predominant wind directions at this site are from the westerly quadrant. Approximately 50 percent of all wind directions monitored at this site were within the directional range of southwest to northwest. Wind directions in Eccles Canyon show similar characteristics, however, the canyon site shows a much larger frequency of easterly winds than the Boardinghouse Peak station. This may be attributed to daytime upslope flow conditions in the canyon which are decoupled from the upper air flows. Wind roses extracted from Coastal States monitoring reports are presented in Appendix B.

Dispersion Meteorology

When considering the fate of pollutants released into a confined valley setting, one must pay particular attention to the frequency and strength of inversions formed in the valley. During inversion conditions, pollutants may be trapped in a relatively limited layer of air near the ground and ambient levels may remain elevated until inversion breakup. Also of importance during these conditions is the downslope wind speed with which pollutants are flushed from the system. Thus, pollutant buildup is inversely proportional to the valley wind speed and mixing volume.

Boundary layer studies performed in Eccles Canyon indicate that deep surface based inversions can occur with some frequency. The depths of these inversions varied from 100 to 500 meters. Upslope conditions were also found to be present frequently during periods of high solar insolation. In these cases, the upslope winds were usually shallow (generally less than 100 meters) and gave way to synoptic flow at higher levels. This decoupling was not found during periods of cloud cover or strong synoptic flow and channelling conditions.

4.0 Air Quality Impacts Assessments

This section presents an assessment of the ambient air quality impacts anticipated from UCO's Scofield Mine facilities. BEAK has used a simple yet conservative mass continuity modeling technique to predict future particulate concentrations within Winter Quarters Canyon.

The topographic restraints on dispersion of atmospheric emissions as described in Section 3.0, require that a non-traditional method be used to estimate concentrations within Winter Quarters Canyon. Specifically, the obstructions to and channelling of air flow within the valley, combined with density driven slope flows, make the use of traditional straight-line trajectory Gaussian plume models inapplicable for such situations. As a substitute, the technique of multiple-ventilated box modeling has been applied to the UCO emissions and dispersion scenario.

Because of its simplicity, the box modeling techniques has some inherent limitations. It is best suited to predict concentrations during stable downslope or drainage flow conditions which persist for several hours. Fortunately, air pollution potential in steep-walled, confined situations is at a maximum during long term drainage flow situations. At these times pollutants may be confined not only by the topography but also by the presence of elevated inversions and light wind speeds for valley ventilation.

The multiple-box model used here addresses this concept of dispersion within a confined area. It does so by using a series of user-defined boxes into which variable amounts of particulates are released. The box dimensions are determined by the topography. Emissions into a given box are assumed to distribute instantaneously and uniformly through the box. Air from upwind boxes has pollutant burden due to sources in each downwind box added to it as it enters that downwind box. Upwind boxes without sources supply ventilation air only.

Since drainage flow situations typically begin at night or early evening, the air pollutant concentration within each box increases from zero to some equilibrium value determined by wind speeds and box dimensions. From mass conservation arguments, the rate of change of pollutant mass in a given box is equal to the rate at which pollutants are released into the box from sources within the box plus the rate at which pollutants are entering from upwind boxes minus the rate at which the pollutant is being advected out of the box downwind. Thus;

$$\frac{dM_i}{dt} = Q_i - \frac{A_i u_i M_i}{V_i} + \sum_{\text{boxes}}^{\text{Upwind}} \frac{A_j u_j M_j}{V_j}$$

where, M_i = mass of pollutant in i^{th} box

Q_i = rate of pollutant release in i^{th} box

A_i = cross sectional area of i^{th} box

u_i = wind speed within i^{th} box

V_i = volume of i^{th} box

It is important to remember that the wind speeds within each box are not necessarily constant from box to box due to valley constrictions. In addition, the heights of each box must be chosen to be representative of the height into which the effluents are contained (mixing height). The differential equation given above must be solved as a function of time for all boxes which cover the area of interest. Variable emission rates (by time of day) may also be considered.

The model used here solves the differential equation above as a function of time, considering varying emission rates and box configurations. Box dimensions are user-selected based upon the topography and source configuration within each box. The wind speeds within each box which do not have boxes further upwind area also selected by the user. The wind speeds in boxes further downwind are calculated by the model based on mass continuity.

The box modeling performed for UCO utilizes a maximum worst case drainage flow scenario of 24 hours in total duration. This is a somewhat conservative episode that might potentially occur during the late fall and winter months.

Valley cross-sections and the box configuration selected for the analysis are shown in Figures 4-1 through 4-4. The compact nature of the processing facilities forces all process-related emissions into a single box, additional boxes are selected for haul road vehicle emissions and ventilation flow (upvalley and upslope boxes) for continuity purposes. The empty upslope and upvalley boxes dictate the ventilation rates that are to be expected in the critical downwind effluent-laden boxes. These boxes in effect supply clean dilution air to the canyon configuration.

Box input variables for the model are shown in Table 4-1. Only wind speeds for Boxes 1, 2, and 4 are user selected, the other wind speeds are calculated through mass continuity. The resulting wind speeds in the emission laden boxes are all less than 2.4 meters per second. Thus, a very realistic worst case drainage wind is simulated. Emissions from all processing sources are wholly contained in Box 5. It also containes one-fourth of all vehicular and haul road emissions; the remainder of which is apportioned uniformly through Boxes 6 through 8.

Figure 4–1

CROSS SECTION "A"

One–Half Mile West of the UCO Scofield Mine Site

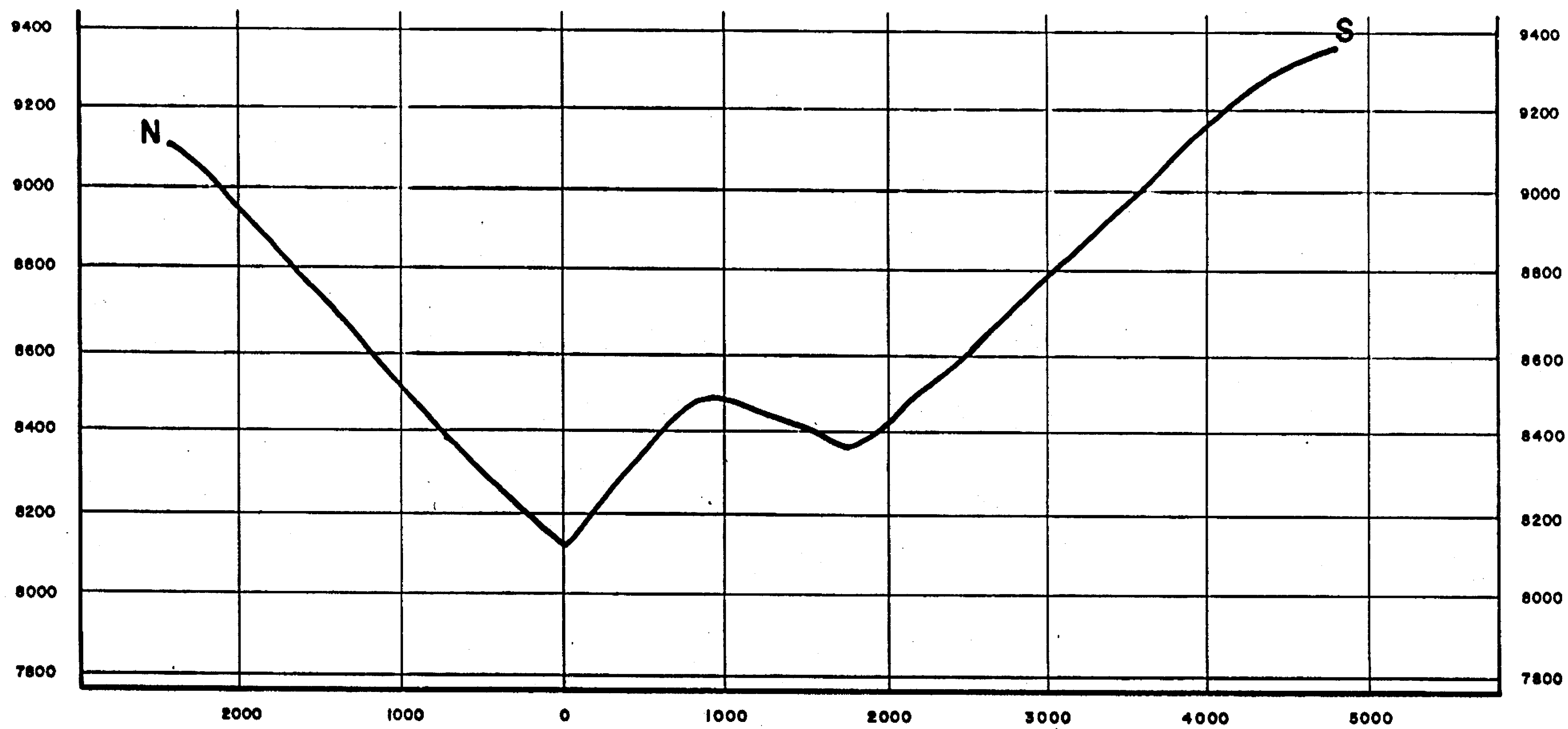


Figure 4–2

CROSS SECTION "B"

Through the UCO Scofield Mine Site

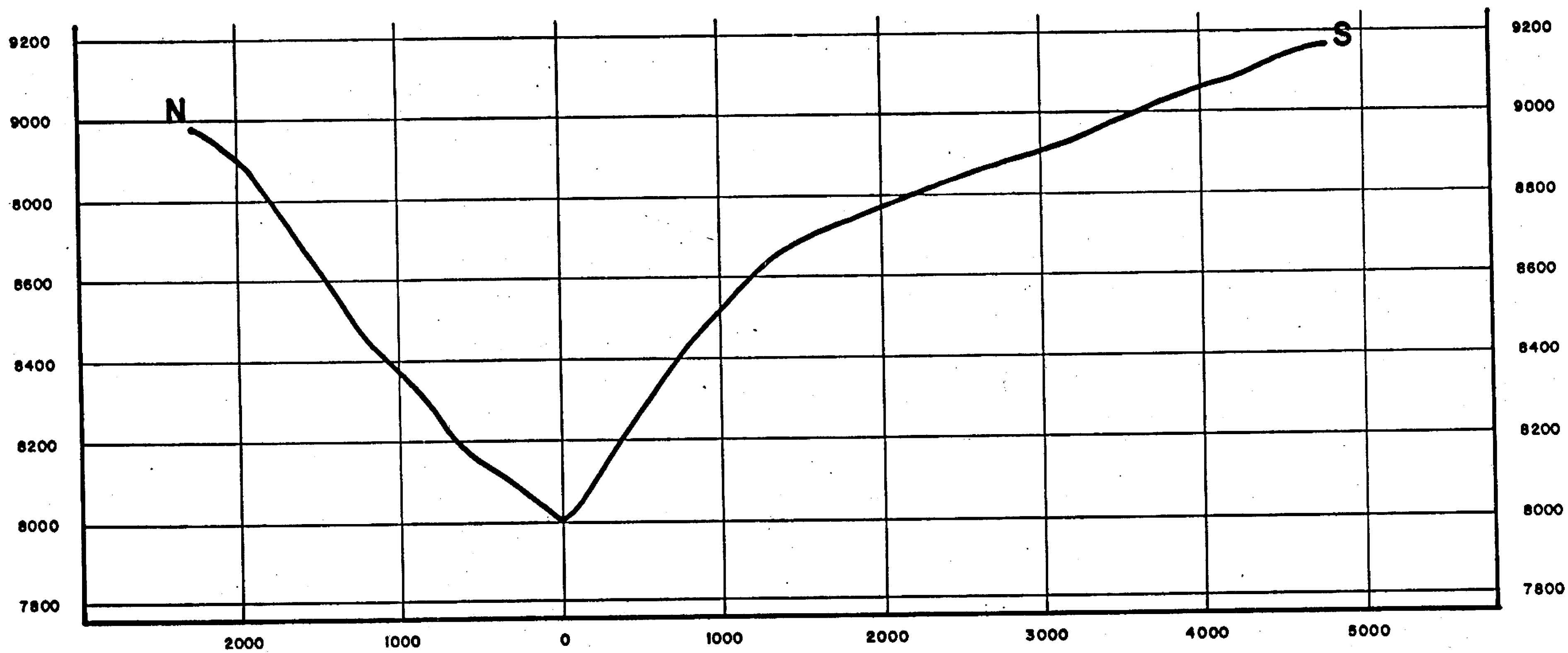


Figure 4-3

CROSS SECTION "C"

One-Half Mile East of the UCO Scofield Mine Site

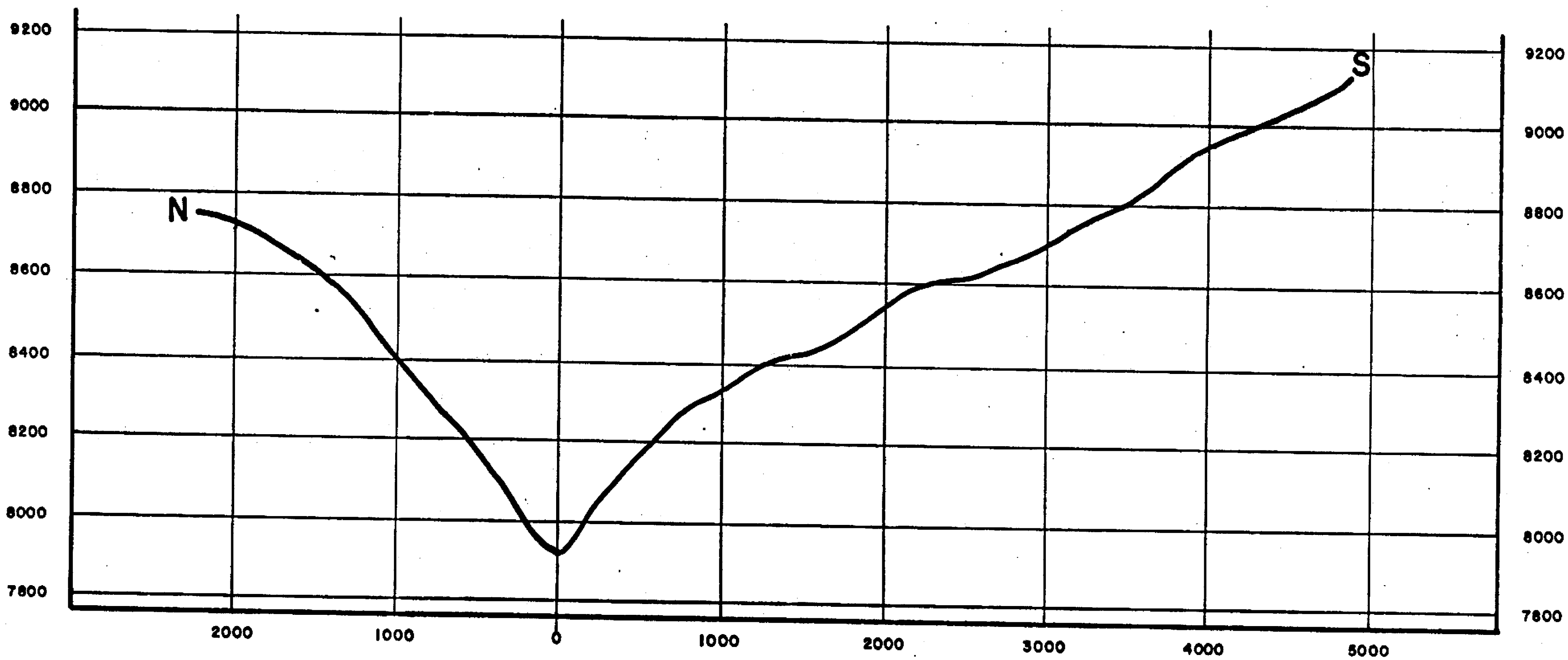


TABLE 4-1 BOX DIMENSIONS AND RESULTANT METEOROLOGY - COMPUTER PRINTOUT

BOX NO.	LENG (M)	HGT (M)	WID (M)	ANG1	ANG2	UPWIND BOXES			WIND M/S	AREA (M2)	VOLUME (M3)	FLUSH FREQ
1	450.	50.	275.	90.	90.	0	0	0	1.50	.138E+05	.619E+07	.333E-02
2	550.	20.	450.	90.	90.	0	0	0	1.50	.900E+04	.495E+07	.273E-02
3	600.	50.	275.	90.	90.	1	2	0	2.48	.138E+05	.825E+07	.414E-02
4	350.	20.	200.	90.	90.	0	0	0	1.00	.400E+04	.140E+07	.286E-02
5	500.	50.	350.	90.	90.	3	4	0	2.18	.175E+05	.875E+07	.436E-02
6	450.	50.	350.	90.	90.	5	0	0	2.18	.175E+05	.788E+07	.484E-02
7	600.	50.	350.	90.	90.	6	0	0	2.18	.175E+05	.105E+08	.363E-02
8	600.	50.	350.	90.	90.	7	0	0	2.18	.175E+05	.105E+08	.363E-02

Table 4-2 displays the distribution by percentage of each source category emission allocated to each box. In view of the source emissions' spatial distribution, Box 8 will depict the worst-case, off-property, concentration condition.

A summary of hourly emission rates into each box over the 24-hour period is shown in Table 4-3. It has been assumed that all mining operations and vehicular traffic are constant throughout a 24-hour period. Thus, hourly emissions within each box do not vary, simulating a very conservative condition.

The results of the modeling and the flow parameters from the box configurations are shown in Table 4-4. The last column displays the worst case 24-hour average concentration predicted in each box. Boxes 5, 6, 7, and 8 have non-zero concentrations. All other boxes lack sources or are upwind boxes without transported pollutant burden.

Box 8 displays the highest predicted 24-hour concentration of 43 $\mu g/m^3$. This value occurs because all mining activity emissions accumulate upwind and are transported into Box 8. Despite the severity of the chosen worst case 24-hour meteorological condition, the maximum concentration is only 43 $\mu g/m^3$. Background air quality is relatively good. Total suspended particulate (TSP) data collected from Boardinghouse Peak, approximately five miles south of the mining site, during the summer of 1979 indicated an average value of 35 $\mu g/m^3$. for a 24-hour period. Since summertime conditions typically yield the highest TSP concentrations, a background value of 35 $\mu g/m^3$ should provide a reasonably conservative estimate. For a worst case 24-hour condition, an ambient TSP concentration of 78 $\mu g/m^3$ could be expected. This concentration is well below the NAAQS 24-hour secondary standard of 150 $\mu g/m^3$.

PERCENTAGE OF SOURCE CATEGORY EMISSIONS

ASSIGNED TO INDIVIDUAL BOXES

MODELING ANALYSIS

TABLE 4-2

Source	Box #5	Box #6	Box #7	Box #8
Haul Road	25%	25%	25%	25%
Primary Crushing	100%	-	-	-
Conveyors and Transfer	100%	-	-	-
Silo Loadout	100%	-	-	-
Wind Erosion	100%	-	-	-
Stockpile Emissions	100%	-	-	-
Miscellaneous Vehicular Emissions	25%	25%	25%	25%

TABLE 4-3 HOURLY EMISSION RATES FOR MODELED BOX CONFIGURATION (g/sec)

BOX NO.	HOUR 1	HOUR 2	HOUR 3	HOUR 4	HOUR 5	HOUR 6	HOUR 7	HOUR 8	HOUR 9	HOUR 10	HOUR 11	HOUR 12
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070
6	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190
7	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190
8	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190

BOX NO.	HOUR 13	HOUR 14	HOUR 15	HOUR 16	HOUR 17	HOUR 18	HOUR 19	HOUR 20	HOUR 21	HOUR 22	HOUR 23	HOUR 24
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070	1.070
6	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190
7	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190
8	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190	.190

24-HOUR MODELING RESULTS AND WIND

FLOW PARAMETERS

TABLE 4-4

Box #	Length (M)	Height (M)	Width (M)	Wind Speed (M/sec)	Flushing* Period (Sec)	24-Hour Average Concentration ($\mu g/m^3$)
1	450	50	275	1.50	300	0
2	550	20	450	1.50	366	0
3	60	50	275	2.48	242	0
4	350	20	200	1.00	350	0
5	500	50	350	2.18	230	28
6	450	50	350	2.18	206	33
7	600	50	350	2.18	275	38
8	600	50	350	2.18	275	43

* Flushing period is the time for each box to reach 1/e of its final pollutant burden due to sources within that box.

The conservatism of the worst case 24-hour TSP concentration estimate results from the chosen set of meteorological conditions. A drainage condition capped by a low mixing height (50 meters) has been assumed to occur throughout all 24 hours of a particular day. Usually, drainage winds induced by nighttime cooling are present from early evening to mid-morning of the next day. Winds during daylight hours increase substantially as early morning inversions are broken. Wind speeds during the input meteorological conditions were determined by preventing values above 2.5 meters per second, the historically recommended worst case value. The highest wind speed of 2.48 meters per second occurred in Box 3. The lowest wind speed, 1.0 meters per second, occurred in Box 4 and is considered a nearly calm wind. For all cases, winds were either at or well below the 2.5 meter-per-second wind speed.

In conclusion, the conservative nature of the modelled meteorological conditions only produced a worst case 24-hour TSP concentration of 43 $\mu g/m^3$. When added with background, the total ambient concentration of 78 $\mu g/m^3$ is well below any of the applicable NAAQS. Under normal conditions, TSP levels should be significantly lower than the predicted value of 78 $\mu g/m^3$.

5.0 REFERENCES

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APPENDIX A

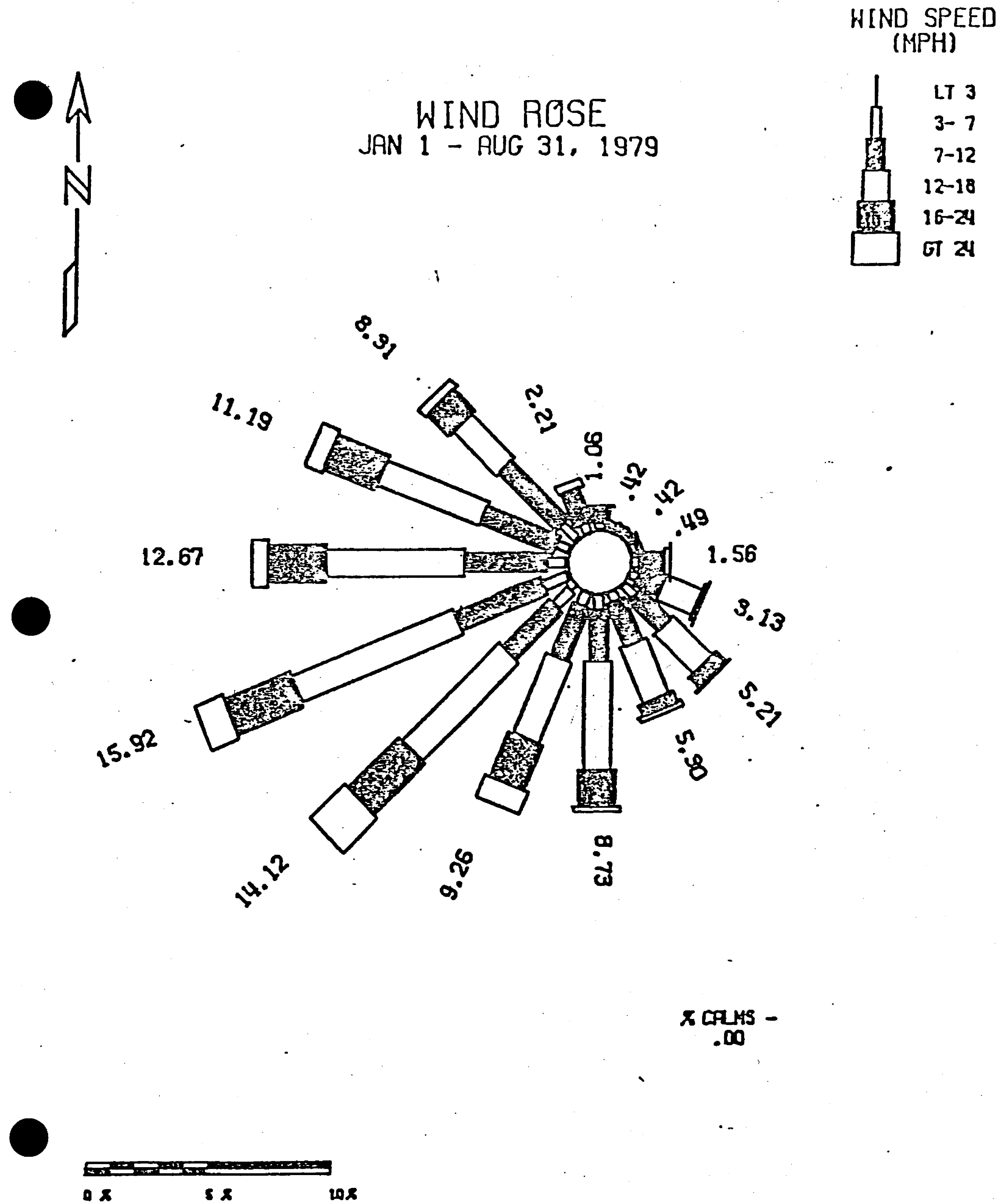
FACILITIES

APPENDIX B

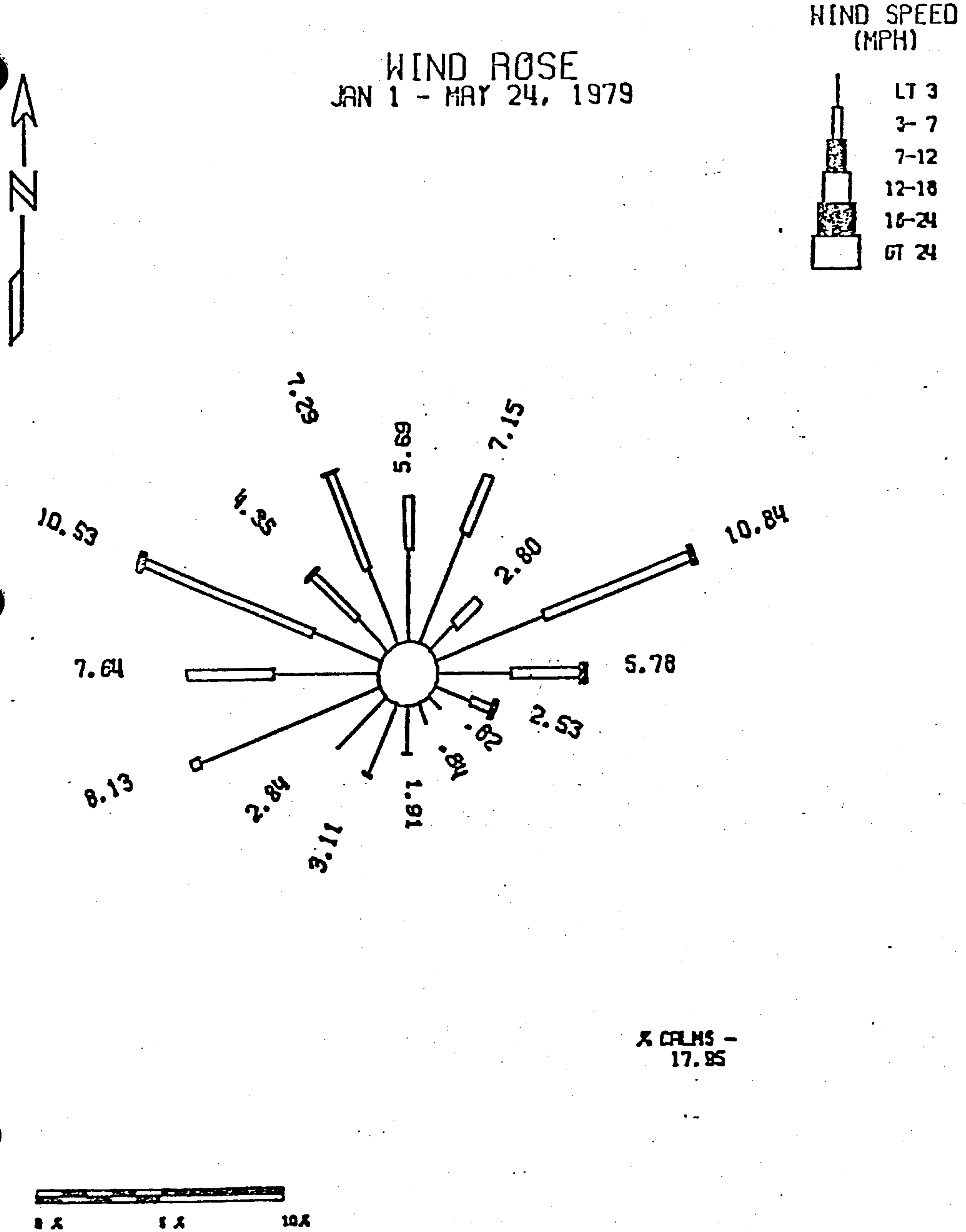
WIND ROSES FROM COASTAL

STATES ENERGY PROGRAM

WIND ROSE
JAN 1 - AUG 31, 1979

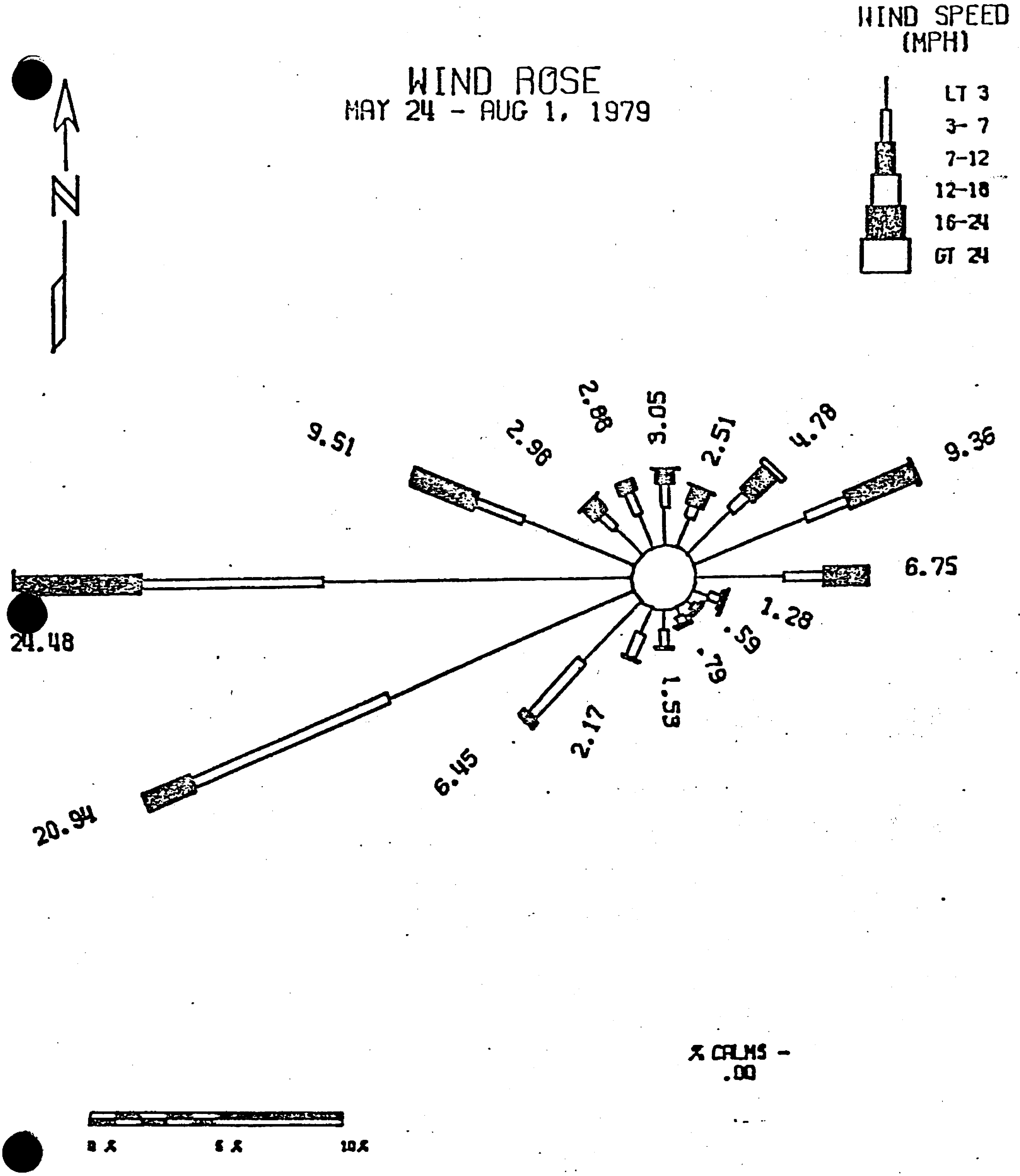


BOARDINGHOUSE PEAK - SITE 040



ECCLES CANYON

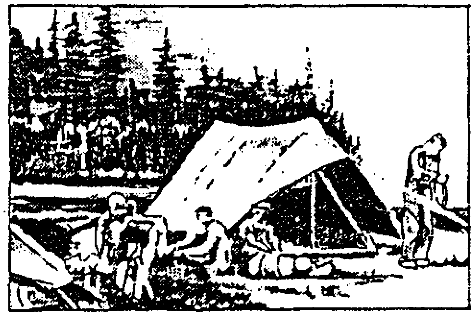
WIND ROSE
MAY 24 - AUG 1, 1979

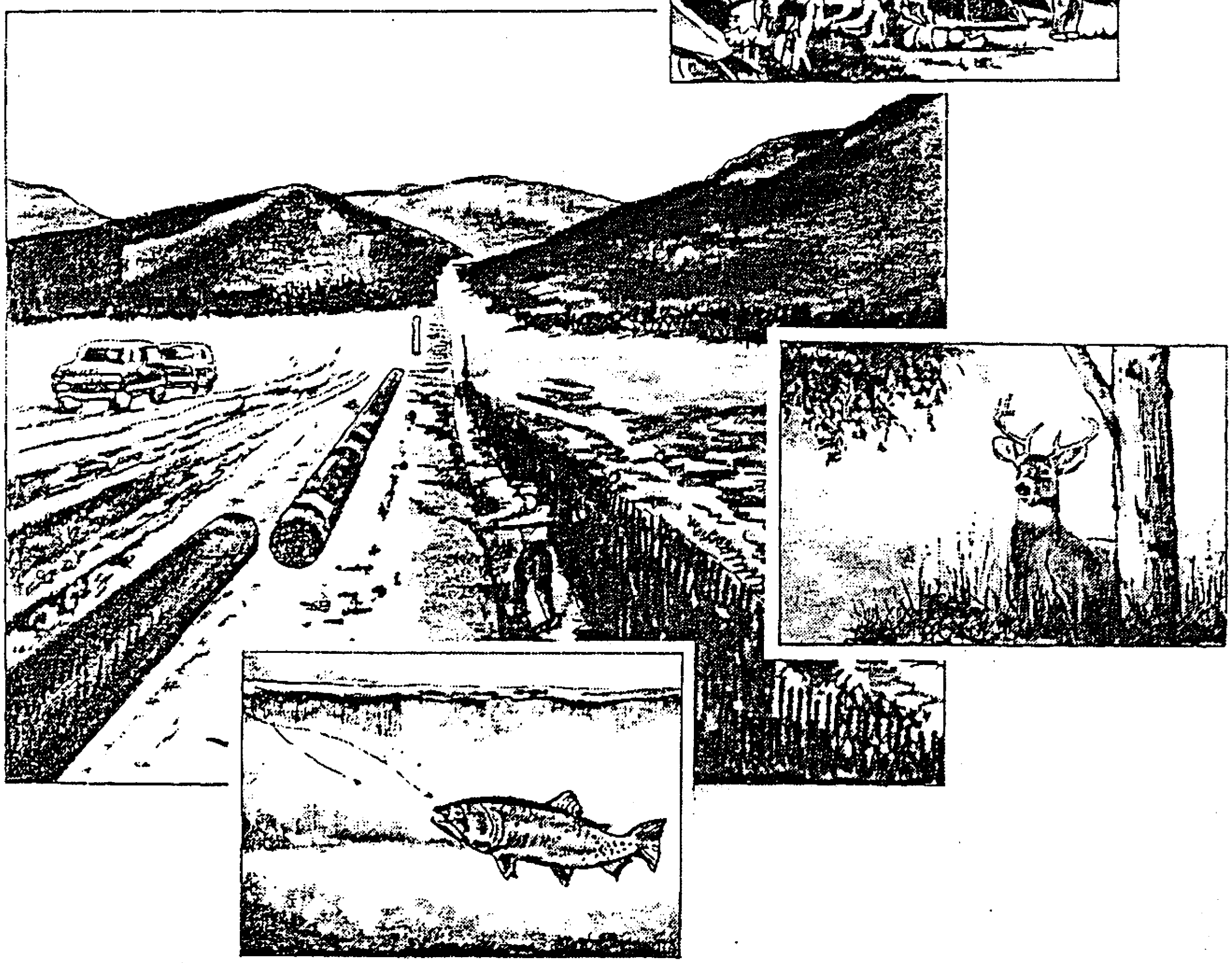


ECCLES CANYON

QUESTAR PIPELINE COMPANY'S
MAIN LINE No. 41
FINAL ENVIRONMENTAL IMPACT STATEMENT
DAMES & MOORE, 1990

Questar Pipeline Company's





Main Line No. 41
Reroute at Skyline Mine

Final Environmental Impact Statement

US Department of Agriculture
Forest Service, Manti-La Sal National Forest

JULY 1990
Dames & Moore

TABLE OF CONTENTS

AIR QUALITY

Air quality in the region is generally good due to the lack of major pollution sources. There are no Class I airsheds in the vicinity. Although monitored data are not available for the project area, there is no reason to expect that air quality attainment standards are being violated for any monitored pollutant.

The major local nonpoint sources of air emissions are vehicles on the highways and roads, which emit carbon monoxide and create fugitive dust (on dirt roads).

AIR QUALITY

Short-term low impacts to air quality are anticipated. During construction, the processes of clearing land and excavating the trench and the movement of equipment have the potential for generating fugitive dust. Emissions of carbon monoxide, nitrogen oxides, and hydrocarbons would be emitted by equipment fueled with gasoline, diesel oil, or other fossil fuel. Fugitive dust generated during construction would be controlled by applications of water on cleared land.

After construction, fugitive dust potentially could be generated by wind on exposed soil of cleared land if the appropriate mitigation measures are not implemented.

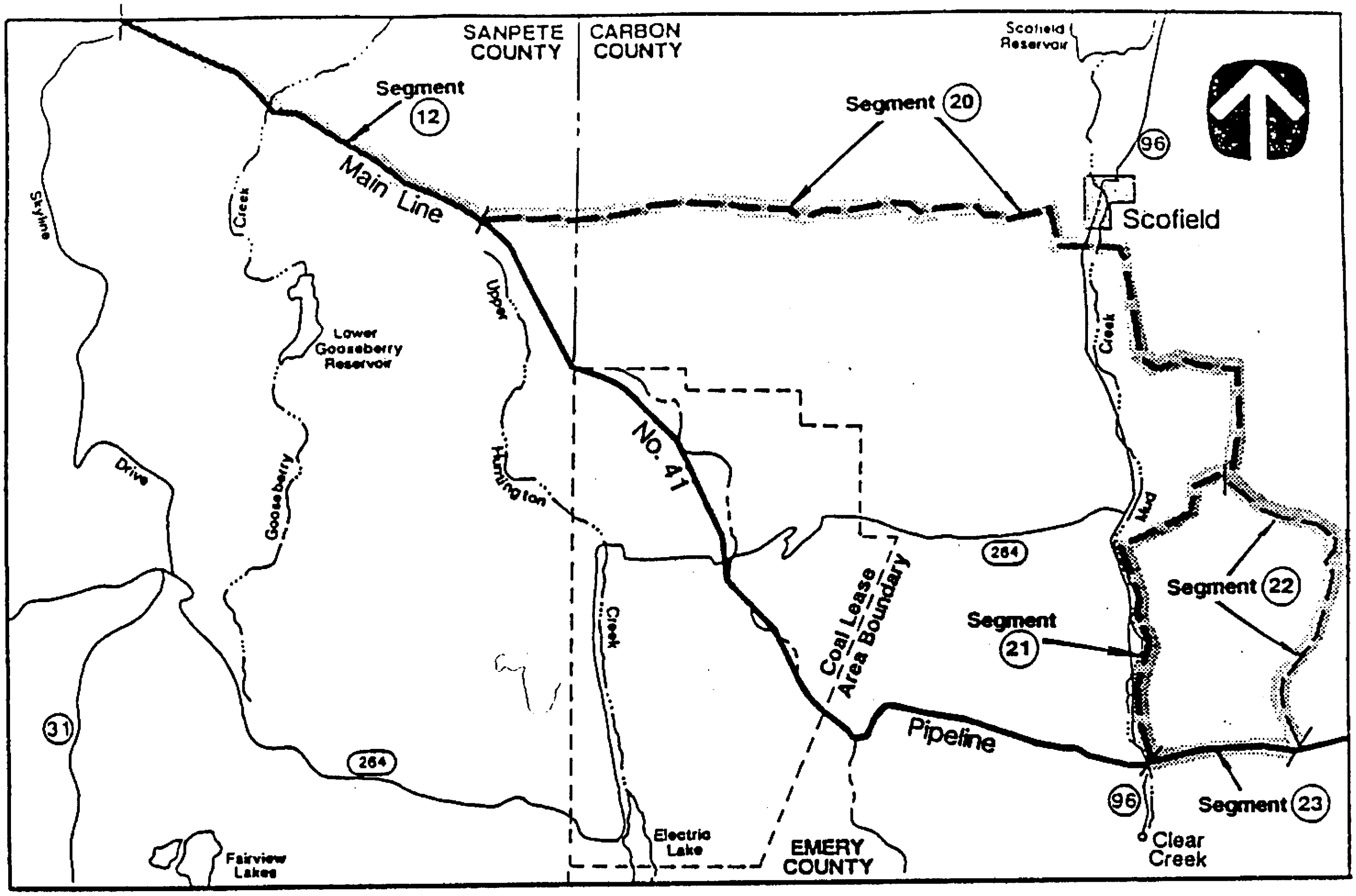


FIGURE B-4. THE WINTER QUARTERS ROUTE

Segments 12*, 20, 21, 23*; variation Segment 22; associated Segment 19*

Segment 12* (3.7 miles in length) is part of the existing pipeline and for purpose of this study begins in the northwest quarter of Section 25, T.12 S., R.5 E. (SLM) at the headward side of the Cabin Hollow Creek Drainage. The pipeline trends southeasterly from near the junction of Skyline Drive and an unimproved two-track road, the latter of which runs adjacent to the pipeline for one-half mile before turning south. One-third mile thereafter, the pipeline begins descending some 1,000 feet in elevation over the next mile to the crossing at Gooseberry Creek, then ascends nearly 1,400 feet over the remaining 2.2 miles.

An unimproved two-track road roughly parallels the pipeline for some 2.6 miles beginning about 0.4 mile west of the Gooseberry Creek crossing to the eastern end of Segment 12*. The roadway crosses the pipeline at numerous locations along the segment.

Segment 20 (9.1 miles in length) trends east/west for approximately two-thirds of its proposed length along the upland reaches of Winter Quarters Ridge before descending just west of Scofield to crossings situated at an unimproved two-track road, Winter Quarters Creek and Mud Creek. After skirting the southern corporate limits of Scofield, the segment turns southward just east of Mud Creek atop the ridgeline separating Pleasant Valley on the west and UP Canyon to the east for the distance of 1.1 miles. At

that point, the proposed segment turns east for .75 mile and then south for the remaining distance.

An unimproved two-track road would run adjacent to the proposed pipeline segment from the vicinity of Scofield to the junction with either Segment 21 or 22.

Segment 21 (3.1 miles in length) descends the ridgeline north of Broads Canyon crossing along its course 2 unimproved roads and the stream at the mouth of Broads Canyon before reaching and crossing Mud Creek. The proposed pipeline segment then runs upstream adjacent to and west of Mud Creek until the mouth of Slaughter House Canyon where the pipeline crosses to the east side of the creek near an existing highway culvert. The segment then continues upstream to connect with the existing pipeline just east of Utah State Highway 96.

Segment 23* (1.3 miles in length), part of the existing pipeline, differs in elevation by over 1,200 feet between the western end (lowest) and eastern end (highest) of the segment. The pipeline follows the ridgeline between Boneyard Canyon on the north and Magazine Canyon to the south and continues eastward to a topographic feature referred to as "The Elbow". This location marks the eastern extent of the proposed pipeline reroute project and is situated in the southwestern quarter of Section 27, T.13 S., R.7 E. (SLM).

Segment 22 (3.3 miles in length) is an eastern alternative for the Winter Quarters Route. The proposed segment instead of descending along the ridgeline of Broads Canyon like Segment 21, sidles eastward and southward along the upper reaches of Broads Canyon before rejoining the existing pipeline at "The Elbow". Unimproved two-track roads exist adjacent to the proposed pipeline alignment.

Segment 19* (2.8 miles of existing pipeline) is not a part of either Winter Quarters Routes (1) or (2). However, if either of these routes is selected, the existing pipeline of Segment 19* cannot be abandoned as it is needed to supply gas to a tap line that joins Main Line No. 41 at the western terminus of Segment 19*. Because this segment cannot be abandoned, the environmental resources are addressed along Segment 19* not as part of the routes, but as a segment associated with the route.

The first one-half mile on the western end of Segment 19* trends northeasterly before turning in a southeasterly direction. The southeastern component follows the ridgeline between Slaughter House Canyon on the north and Boardinghouse Canyon to the south and crosses and runs parallel to a unimproved road for nearly 0.5 mile at the western end of the component. At the eastern end of the segment, the topography descends nearly 1,100 feet over the last 0.5 mile, crossing State Highway 96 and Mud Creek near the junction with Segment 23*.

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CLEAR CREEK, UTAH
MONITORING PROGRAM
RADIAN CORPORATION, 1979

RADIAN
CORPORATION

DCN 79-120-242-08

SUMMARY REPORT
FOR
COASTAL STATES ENERGY COMPANY
CLEAR CREEK, UTAH
MONITORING PROGRAM
JANUARY 1 TO AUGUST 31, 1979

4 October 1979

Presented to:
Kevin Yocum
Coastal States Energy Company
9 Greenway Plaza
Houston, Texas 77046

Prepared by:
Radian Staff

RADIAN CORPORATION

LIST OF TABLES (CONTD)

LIST OF FIGURES

I. GENERAL DESCRIPTION OF MONITORING PROGRAM

Radian Corporation is under contract to Coastal States Energy Company to provide meteorological and air quality monitoring at sites near Clear Creek, Utah. The routine monitoring network consists of: 1) a shelter and 10-meter tower system located atop Boardinghouse Peak monitoring wind speed, wind direction, temperature, precipitation, net radiation, and solar radiation, and 2) a mechanical weather station located at the base of Eccles Canyon monitoring wind speed, wind direction, and temperature. The Boardinghouse Peak and Eccles Canyon meteorological monitors are taking continuous measurements for one year from January 1, 1979 through December 31, 1979. Particulate sampling will be performed at the Boardinghouse Peak site during the five-month period from June 1, 1979 through October 31, 1979.

All instrumentation incorporated into the monitoring program meets or exceeds the specifications in EPA's Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), May 1978. The shelter system atop Boardinghouse Peak is an existing radio station shelter with exclusive lease rights to Radian for the purpose of this monitoring program. The data system at the Boardinghouse Peak site is a Radian-designed and manufactured DART I which generates hourly hardcopy reports of five-minute averages and daily summaries of hourly averages as well as recording the data on industry-compatible 9-track magnetic tape. Single-channel Esterline-Angus stripchart recorders provide additional backup to the DART I data system.

In addition to the routine monitoring program described above, Radian Corporation is performing several short-term, special monitoring programs at Eccles Canyon and at Clear Creek. These include a special particulate sampling program, an upper level atmopsheric sounding program, and a special noise study. These programs are discussed in Section VI.

II. SITE DESCRIPTIONS

Boardinghouse Peak Site

The meteorological monitoring station atop Boardinghouse Peak is at an elevation of 9,943 feet. The site is approximately 2½ miles northwest of the community of Clear Creek.

The site is virtually free of obstructions to the wind. Although there are many trees in the vicinity, the tops of all but one tree are below the crest of the mountain. A single deciduous tree about 100 feet northeast of the meteorological tower will cause a slight decrease in wind speeds and a slight increase in wind direction fluctuations for northeasterly winds, which are very infrequent at the site. During winter, when the tree is bare, its effects will be almost unnoticeable. The radio shelter located approximately 60 feet north of the meteorological tower will have little effect on winds since the top of the shelter is below the base of the tower. A radio tower about 30 feet north-northwest of the meteorological instrumentation will very slightly affect wind speeds and wind directions for north-northwesterly winds.

Eccles Canyon Site

The mechanical weather station at Eccles Canyon is at an elevation of 7,950 feet. The site is approximately 3 miles north of the community of Clear Creek. Prior to May 24, 1979, the station was located approximately 75 yards to the west of Highway 96, which runs along the floor of Pleasant Valley. On May 24th, the station was moved to a point approximately 120 yards west of the highway and about 40 yards northwest of the former site.

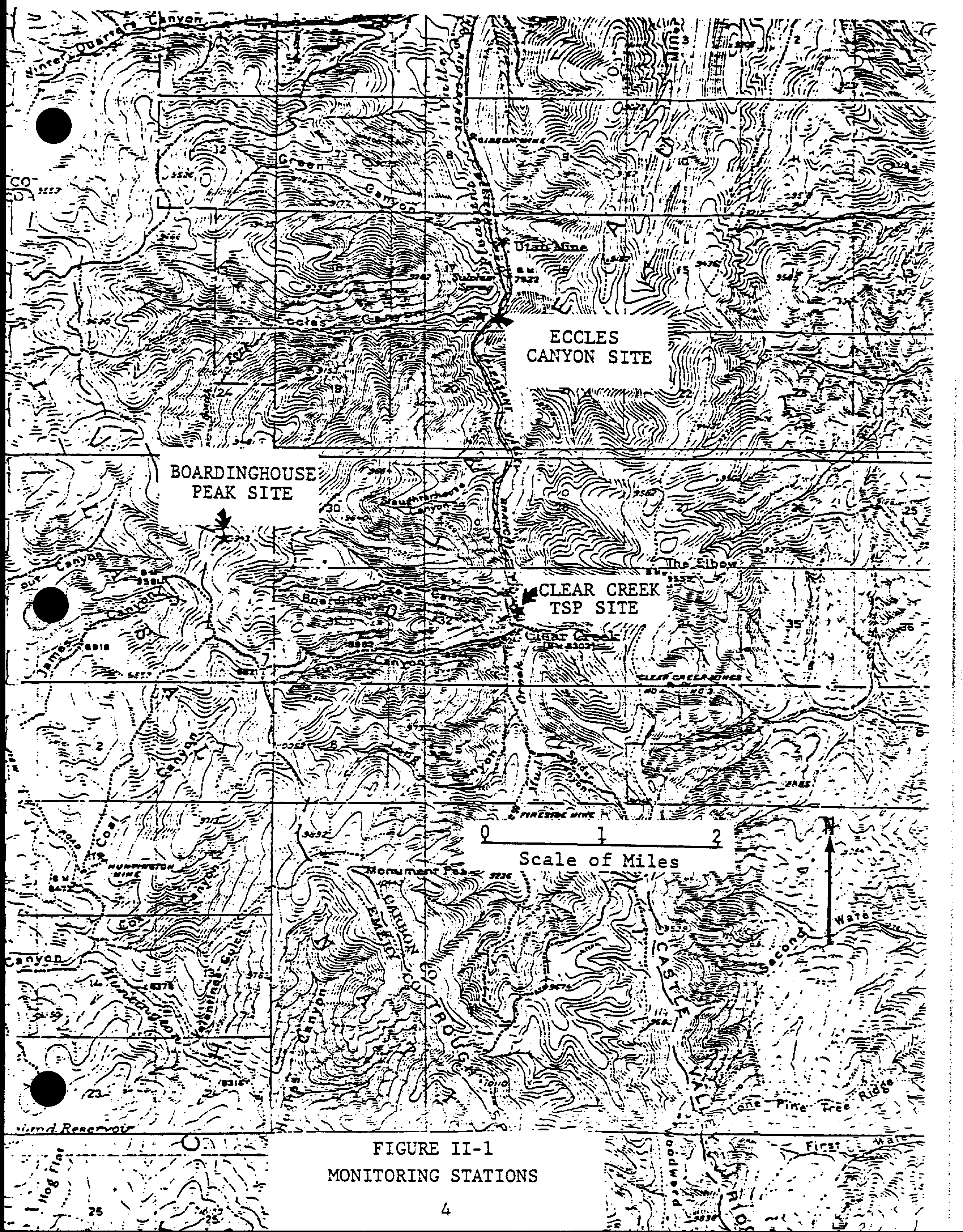

FIGURE II-1
MONITORING STATIONS

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The weather station is located at the junction of Eccles Canyon, which runs east and west, and Pleasant Valley, which runs north and south. The terrain rises sharply on either side of both Eccles Canyon and Pleasant Valley. The actual flow at the site during daytime hours will be the result of a combination of the large scale flow over the region, channeling effects, and up-valley flows in Eccles Canyon and Pleasant Valley (the up-valley flows in Eccles Canyon is east to west, while in Pleasant Valley, north to south). During months of heavy snow cover, when surface heating is insufficient to create a strong up-valley flow, the actual flow at the site will be primarily a combination of the large scale flow and channeling effects. During nighttime hours, the actual flow at the mechanical weather station site will be the result of a combination of the large scale flow, channeling effects, and down-valley flows in Eccles Canyon and Pleasant Valley. Down-valley flows are most pronounced during periods of clear skies and very light winds. In summary, the actual flow of air at the site will be heavily influenced by the complex terrain of the area. The resulting flow will depend on the relative strengths of the contributing factors.

It should be noted that the heavy growth of evergreen trees close by to the southeast through southwest of the mechanical weather station will significantly reduce wind speeds for southeasterly through southwesterly winds.

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III. SYSTEM DESCRIPTION

A. Data Acquisition System

The data acquisition system used to collect and reduce continuous air monitoring data consists of the Radian-designed DART (Data Acquisition Reduction and Transmission) system. This sophisticated data acquisition system is designed to meet most air monitoring applications, and provides the following features:

1) System operation completely under software control.

2) Real time data processing.

3) Hardcopy printout provided on-site for inspection by operators.

4) Operator key-ins for setting system parameters and checking system operation.

5) Daily self-diagnostics.

6) Computer-controlled calibration of instruments.

7) Computer monitoring of status of many key functions.

8) Data recorded on industry compatible seven- or nine-track magnetic tape.

9) Battery-powered clock which enables computer to always maintain correct time, and to identify duration and time of power failures.

Radian's data collection system is designed around a Motorola M6800 microprocessor. The use of a microprocessor allows a variety of sophisticated data collection schemes with virtually no hardware expansion. Radian's standard system uses 16K (expandable to 65K) of random access memory. A built-in cassette tape unit is used for program storage and loading. As a result, by simply changing the program tape an entirely different system configuration can be implemented. Many system parameters, such as sampling times, averaging times, input voltage ranges, printout formats, and recording techniques are under software control.

The microprocessor is a general-purpose computer which, with appropriate software loaded from the cassette, can perform any programmable function. Using Radian's Relocatable Assembler and Relocatable Loader, Radian's standard data acquisition program can be modified to include new averaging or data reduction techniques. For example, equations to correct non-linear input values or data reduction routines to calculate vector averages for wind parameters can be added to the system software. Various line protocols for telecommunications, new operator key-ins, and changes to report formats are other features that can be changed or incorporated into the data acquisition system with only software changes.

Radian's standard data collection program takes one-second samples from each data channel and then uses this data to form five-minute averages for each channel. These five-minute averages form the basis for further data reduction. After one hour of five-minute averages have been collected the microprocessor energizes, through relay control, the teleprinter and prints a hardcopy of the collected data, as well as recording the data on magnetic tape. Since the teleprinter is a mechanical device, the microprocessor turns the teleprinter off after the printout is completed, greatly enhancing its lifetime. The magnetic tape transport used in the system is an industry-compatible, incremental write, seven- or nine-track unit. The unit is equipped with an auto-load feature which automatically reloads and erases several inches of tape following a power outage.

An interface in the microcomputer unit, the Device Controller, allows the microcomputer to control the power to various devices such as the teleprinter, cassette unit, and particulate samplers. The Device Controller can handle up to sixteen devices. Each device can either be wired for a contact or closure, useful in the autocalibration of instrumentation, or wired to switch 115 VAC. The Device Controller can be accessed either by the microcomputer or by an operator via a lighted pushbutton switch panel. When an operator sets a switch, this information is available as status information to the microcomputer and recorded along with the data collected during this time. Therefore, there are no unexplained events in the recorded data due to operator intervention.

The analog-to-digital voltage conversion unit (A/D) incorporated in the DART is custom built by Radian for air monitoring applications. It has 16 channels, each with individually adjustable amplifiers to enable it to accept various types of input signals. The A/D unit has 12 bit accuracy, i.e., the full-scale input signal is divided into 2048 segments. Channels can be manually selected for display via a thumbwheel switch.

The device controller allows the minicomputer to assume control functions in addition to its regular duties as a real time data processor. This unit consists of a blank of relays which are controlled by the computer. The relays control power to the high volume particulate samplers, the zero/span valves in the analyzers and the main power switch to the station. Interior temperature is monitored and recorded, and if the temperature rises above 90°F, the main power switch is thrown. This prevents over-heating of the station in case of air-conditioner failure. The relays also control power to the hard-copy printer and the magnetic tape unit. The computer turns these on only when they are needed, reducing their duty cycle to less than ten percent of real time.

The keyboard/printer is the Teletype Model 43. This unit has an impact matrix print head and full 132-character width with an unusually high quality print image.

B. Meteorological Systems

Boardinghouse Peak Site

Wind speed and wind direction sensors are mounted atop a 31-foot wooden pole (without guy wires) planted in the ground. A pyranometer and net radiometer are mounted on the same pole, at approximately 6½ feet above the ground, while an aspirated temperature sensor is mounted at approximately 5 feet above the ground.

Wind Speed Sensor

Wind speed is measured with the Met One, Incorporated, Model 010 Wind Speed Sensor (stainless steel cups). This sensor is supplied with an internal heater which heats the sensor and prolongs the bearing life. The heater produces a slight positive pressure which prevents "dirty air" from being drawn in, thereby increasing the bearing life.

Specifications

- Maximum Operating Range - 0-125 mph
- Starting Speed - 0.6 mph
- Calibrated Range - 0-100 mph
- Accuracy - ±1% or 0.15 mph
- Operating Temperature Range - -50°C to +85°C (-58°F to +185°F)
- Response Distance Constant - Less than 5 feet of flow (this is the distance that must be traveled by the air after a wind gust has occurred before the wind speed sensor reaches 63% of the new speed. The

lower this value is, the better the instrument is.)

Wind Direction Sensor

Wind direction is measured with the Met One, Incorporated, Model 020 Wind Direction Sensor, which utilizes a lightweight air foil vane for sensing wind direction. This sensor is supplied with an internal heater similar to the one described for the wind speed sensor.

Specifications

- Operating Range (Azimuth) - 0° to 540°
- Starting Threshold - 0.6 mph
- Linearity - ±½% of full scale
- Accuracy - ±3°
- Damping Ratio - 0.4 to 0.6
- Delay Distance - Less than 3 feet

Aspirated Ambient Temperature Sensor

Temperature is sensed by the Met One, Incorporated, Model 060-2A Temperature Sensor. This thermistor-type sensor is housed in a heated motor-aspirated radiation shield, the Met One, Incorporated, Model 076 Aspirated Temperature Shield. The heating system affects the aspirator motor assembly only, and does not affect measurements of ambient temperature.

Temperature Sensor Specifications

- Operating Range - -50°C to +50°C
- Linearity - ±0.15°C
- Accuracy - ±0.1°C

Radiation Shield

Specifications

- Operating Temperature Range - -50°C to +85°C
- Radiation Error - Less than 0.05°F under maximum solar radiation of 1.6 gm-cal/cm^2/min.
- Flow Rate -
  Sample Air 500 ft/min.
  Scrubbing Air 1000 ft/min.

Precipitation

Precipitation is measured with the Met One, Incorporated, Model 099S Tipping Bucket Rain/Snow Gauge, which has a wind screen to enhance the capture of wind-driven precipitation.

Specifications

- Operating Range - 0 to 10 inches
- Resolution - 0.01 inch
- Dimensions - 8-inch diameter orifice, 20-inch height
- Counter - Digital counter, analog output
- Accuracy - 0.5% calibrated at ½ inch per hour, or ±1% up to 3 inches per hour (meets PSD suggested accuracy)
- Conversion Accuracy - ±0.2% of the translator module output.

Signal-Conditioner Translators

Plug-in translator cards or "translator modules" from Met One, Incorporated, are used to transform the signals from the above meteorological sensors into desired voltage outputs. These signal conditioning cards are housed in a mainframe (Model 120 by Met One, Incorporated). A power supply card is also housed in the mainframe to provide the electricity requirements of the translator cards. The following types of cards or modules are used:

- Power Supply Module
- Wind Speed Module Model 1180
- 540° Wind Direction Module Model 1190
- Ambient Temperature Sensor Module Model 1230
- Precipitation Sensor Module Model 1270

Net Radiation

Net radiation, which is the difference between incoming and outgoing radiation (both long and short waves), is measured by the WEATHERtronics Model 3035 Net Radiometer. Its sensing element consists of a blackened thermopile.

Specifications

- Data Recording Range - -180 to +180 hundredths of a langley
- Response - ±0.3 to 60 microns
- Time Constant - 12 seconds

Solar Radiation

Total sun and sky radiation are measured by the Eppley Laboratory, Inc., Precision Spectral Pyranometer. Its sensing element consists of a blackened thermopile.

Specifications

- Data Recording Range - 0-200 hundredths of a Langley
- Wavelength Range - 0.28 to 2.8 microns
- Sensitivity - 5.61 millivolts per cal $cm^{-2}min^{-1}$
- Temperature Dependence - Sensitivity is constant to within 1 percent over ambient temperature range -20°C to +40°C (-4°F to +104°F)
- Linearity - Response is linear up to intensities of 4 cal $cm^{-2}min^{-1}$
- Response time - 1 second

Eccles Canyon Site

Wind speed, wind direction, and temperature are measured by the Meteorology Research Incorporated (MRI) Model 1072 Mechanical Weather Station. Data is recorded on pressure sensitive strip chart paper. The MRI Mechanical Weather Station is mounted on an eight-foot high tripod.

Specifications

- Wind Speed Operating Range - .75 to 120 mph
- Wind Direction Operating Range - 0° to 360°
- Temperature Operating Range - -90°F to +120°F

IV. OPERATING TIME ANALYSIS

This section presents the operating statistics for each of the major subsystems contained in the monitoring station. Table IV-1 shows the data capture rates of each of these subsystems during each month from January through August 1979. The data capture rates reflect not only instrument downtime, but also digitizing system downtime. System downtime includes computer downtime, power failures, no power available, and self-automated shutdown periods (such as during air conditioner malfunctions).

Calibration and repair or replacement of meteorological instruments occurs during scheduled calibration visits and, occasionally, during unscheduled maintenance. While such activities are being pursued, the involved channels are interrupted. Such data interruptions are treated as downtime alon[redacted] with the losses of data due to sensor or electronics malfunct[redacted]

The channel abbreviations in Table IV-1 are defined below.

- WS : wind speed
- WD : wind direction
- TMP: temperature
- PYR: solar radiation (total sun and sky)
- RAD: net radiation (incoming minus outgoing)
- WSD: wind direction standard deviation
- RAI: precipitation
- TSP: total suspended particulate

TABLE IV-1
DATA CAPTURE RATES(%) FOR COASTAL STATES
JAN 1, 1979 THRU AUG 31, 1979

SITE 040 BOARDINGHOUSE PEAK

PERIOD		WS	WD	TMP	PYR	RAD	WSD	RAI	TSP
JAN	1-31	99	99	99	99	99	96	99	-
FEB	1-28	100	100	100	100	100	100	100	-
MAR	1-31	100	100	99	97	100	99	100	-
APR	1-30	100	99	100	100	100	99	100	-
MAY	1-31	100	100	100	100	100	100	100	-
JUN	1-30	100	100	100	100	100	100	100	60
JUL	1-31	85	84	100	97	79	84	80	40
AUG	1-31	94	100	98	100	96	100	100	60
ACCUMULATED RATE		97.2	97.8	99.5	99.1	96.8	97.4	97.2	53.3

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TABLE IV-2
DATA CAPTURE RATES(%) FOR COASTAL STATES
(MECHANICAL WEATHER STATION)
JAN 1, 1979 THRU AUG 31, 1979

SITE ECCLES CANYON

PERIOD		WS	WD	TMP
JAN	1-31	32	32	32
FEB	1-28	76	76	76
MAR	1-31	38	38	38
APR	1-30	91	91	91
MAY	1-31	100	100	67
JUN	1-30	93	93	93
JUL	1-31	88	88	88
AUG	1-31	85	85	85
ACCUMULATED RATE		75.4	75.4	71.3

V. DATA PRESENTATION AND SUMMARY

This section includes summaries for various recorded data at the monitoring sites. The data presentations indicate the variability of total suspended particulates and meteorological parameters with time. All parameters, except suspended particulates (24-hour samples), wind direction, wind direction variance, and precipitation are sampled once each second, but recorded as five-minute arithmetic averages of the one-second samples. Wind direction averages are modified to correctly treat winds crossing through north. Variance is computed and recorded from the 300 one-second samples correctly accounting for crossover. Precipitation is cumulative and recorded as five-minute totals. The master data base from which the data tables in this report were generated consists of hourly averages computed from the twelve five-minute averages recorded for each hour. The hourly wind direction standard deviations are computed from the one-second samples using the five-minute wind direction means and variances. Five-minute precipitation totals are summed to make hourly totals. This averaging technique tends to smooth instantaneous maximum values, and the result is especially evident when comparing wind speed values to local National Weather Service data.

The units of the meteorological parameters are given at the top of each table. It should be noted here that inside temperature is monitored and recorded as a functional part of the system but is not presented in this report.

Table V-1 presents the national and Utah ambient air quality standards (NAAQS) for total suspended particulates.

Tables V-2, V-3, and V-4 display the monthly statistics for the monitoring stations for the period of January 1 through

August 31, 1979. The averages in Tables V-2, V-3, and V-4 are arithmetic averages of the hourly values for the associated periods with the following exceptions:

- Wind direction is computed using a vector averaging technique where each vector is assigned a unit magnitude.

- Solar radiation values are averages of daily totals of langleys. The daily totals which are used in computing the monthly values, are computed by summing the hourly averages times 60.

- Precipitation values are cumulative totals of the hourly totals.

- Particulate averages are computed as the geometric mean.

Tables V-5, V-6, and V-7 shows a bivariate distribution of wind direction and wind speed at both sites. Graphical wind roses are shown in Figures V-1, V-2, and V-3 for the Boardinghouse Peak and Eccles Canyon sites, respectively. A graphical three-dimensional summary of wind data is also shown in Figure V-4 for the Boardinghouse Peak site.

Times used in the data presentations correspond to the appropriate local time, i.e., Mountain Daylight Savings Time and Mountain Standard Time, depending on the time of the year.

TABLE V-1
NATIONAL AND UTAH AMBIENT AIR QUALITY
STANDARDS FOR PARTICULATES
($\mu g/m^3$)

Particulate	Primary	Secondary
Annual G.M.*	75	60
24-Hr. Max.**	260	150

*Geometric mean.
**Not to be exceeded more than once per year.

TABLE V-2 MONTHLY AVERAGES FOR JAN 1 THRU AUG 31 1979
BOARDINGHOUSE PEAK

DATE / SITE	WIND SPEED (MPH) 040	WIND DIRECTION (DEG) 040	WIND STANDARD DEVIATION(DEG 040
JAN 1-31	15.6	211.0	10.4
FEB 1-28	16.0	203.9	11.3
MAR 1-31	15.0	261.6	14.6
APR 1-30	17.1	260.6	13.3
MAY 1-31	13.7	266.8	17.6
JUN 1-30	14.0	246.5	18.2
JUL 1-31	13.4	241.5	17.5
AUG 1-31	11.7	225.6	20.3
JAN 1-AUG 31 1979	14.6	241.6	15.4

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TABLE V-2 MONTHLY AVERAGES FOR JAN 1 THRU AUG 31 1979
BOARDINGHOUSE PEAK

DATE / SITE	TEMPERATURE OUTSIDE(DEG F)	PYRANOMETER(LANGLEYS)	NET RADIOMETER (LANGLEYS)
	040	040	040
JAN 1-31	18.8	151.2	2.2
FEB 1-28	25.5	264.0	65.3
MAR 1-31	28.9	324.6	93.4
APR 1-30	35.4	534.0	218.0
MAY 1-31	43.8	583.1	250.0
JUN 1-30	50.2	678.5	294.1
JUL 1-31	57.6	636.6	275.0
AUG 1-31	53.7	505.0	224.0
JAN 1-AUG 31 1979	39.2	459.6	177.8

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TABLE V-2 MONTHLY AVERAGES FOR JAN 1 THRU AUG 31 1979
BOARDINGHOUSE PEAK

DATE / SITE	RAINFALL (HINCH) 040	TOTAL SUSPENDED PARTICULATE(UG/M**3) 040
JAN 1-31	24.0	-
FEB 1-28	14.0	-
MAR 1-31	107.0	-
APR 1-30	44.0	-
MAY 1-31	119.0	-
JUN 1-30	8.0	24.7
JUL 1-31	33.0	49.5
AUG 1-31	175.0	36.1
JAN 1-AUG 31 1979	524.0	35.3

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TABLE V-3 MONTHLY AVERAGES FOR JAN 1 THRU MAY 24 1979
MECHANICAL WEATHER STATION

SITE / DATE	WIND SPEED (MPH) ECCLES CANYON	WIND DIRECTION (DEG) ECCLES CANYON	TEMPERATURE OUTSIDE (DEG F) ECCLES CANYON
JAN 1-31	2	43	-1
FEB 1-28	3	19	10
MAR 1-31	3	11	14
APR 1-30	3	294	31
MAY 1-24	3	290	34
JAN 1-MAY 24 1979	3	352	18

TABLE V-4 MONTHLY AVERAGES FOR MAY 24 THRU AUG 31 1979
MECHANICAL WEATHER STATION

SITE / DATE	WIND SPEED (MPH) ECCLES CANYON	WIND DIRECTION (DEG) ECCLES CANYON	TEMPERATURE OUTSIDE (DEG F) ECCLES CANYON
MAY 24-31	3	273	48
JUN 1-30	3	291	55
JUL 1-31	3	270	63
AUG 1-31	3	264	61
MAY 24-AUG 31 1979	3	275	57

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TABLE V-5 WIND ROSE

WIND SPEED

BOARDINGHOUSE PEAK COASTAL STATES
TRAILER NO. - 40 PERIOD(1/ 1/79 TO 8/31/79)

WIND DIRECTION

WIND SPEED MPH		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM		TOTAL
GT 24	:						1	1	11	12	56	112	71	37	41	21			:	363
18 - 24	:					1	8	34	25	83	108	158	160	129	126	70			:	902
12 - 18	:	4	1	2	1	15	89	126	135	245	198	310	392	312	249	141	19		:	2239
7 - 12	:	36	14	9	11	57	58	96	104	116	127	151	213	191	183	187	81		:	1634
3 - 7	:	16	8	10	13	15	18	33	24	35	33	50	56	41	30	46	25		:	453
LE 3	:	4	1	3	3	0	3	5	1	3	2	18	9	7	4	5	0		:	68
TOTAL	:	60	24	24	28	88	177	295	300	494	524	799	901	717	633	470	125	0	:	5659
MEAN		8.	8.	8.	7.	10.	13.	13.	13.	15.	16.	17.	15.	15.	15.	14.	10.	0.		15.

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TABLE V-6 WIND ROSE (ECCLES CANYON)

WIND SPEED

MECHANICAL WEATHER STATION PERIOD(1/ 1/79 TO 5/24/79) COASTAL STATES

WIND SPEED MPH	WIND DIRECTION N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM	TOTAL
GT 24 :																		: Ø
18 - 24 :																		: Ø
12 - 18 :																		: Ø
7 - 12 :				5	5	3								5	2	1		: 21
3 - 7 :	46	56	32	136	6Ø	19			1	3		9	77	166	56	9Ø		: 751
LE 3 :	82	1Ø5	31	1Ø3	65	35	14	19	42	67	64	174	95	66	4Ø	73	4Ø4	: 1479
TOTAL :	128	161	63	244	13Ø	57	14	19	43	7Ø	64	183	172	237	98	164	4Ø4	: 2251
MEAN	4.	4.	4.	4.	4.	4.	2.	2.	2.	2.	2.	2.	4.	5.	4.	4.	1.	: 1.

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TABLE V-7 WIND ROSE (ECCLES CANYON)

WIND SPEED
MECHANICAL WEATHER STATION PERIOD(5/24/79 TO 8/31/79 COASTAL STATES

WIND DIRECTION

WIND SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM	TOTAL
GT 24 :																		: 0
18 - 24 :																		: 0
12 - 18 :																		: 0
7 - 12 :	1	2	10	5		1							1		1			: 21
3 - 7 :	24	28	52	114	74	7	5	3	3	3	14	83	205	112	28	19		: 774
LE 3 :	37	21	35	71	63	18	7	13	28	41	117	342	291	81	31	39	101	: 1336
TOTAL :	62	51	97	190	137	26	12	16	31	44	131	425	497	193	60	58	101	: 2131
MEAN	4.	4.	5.	5.	4.	3.	4.	3.	2.	2.	3.	3.	4.	4	4	3	1	: 1.

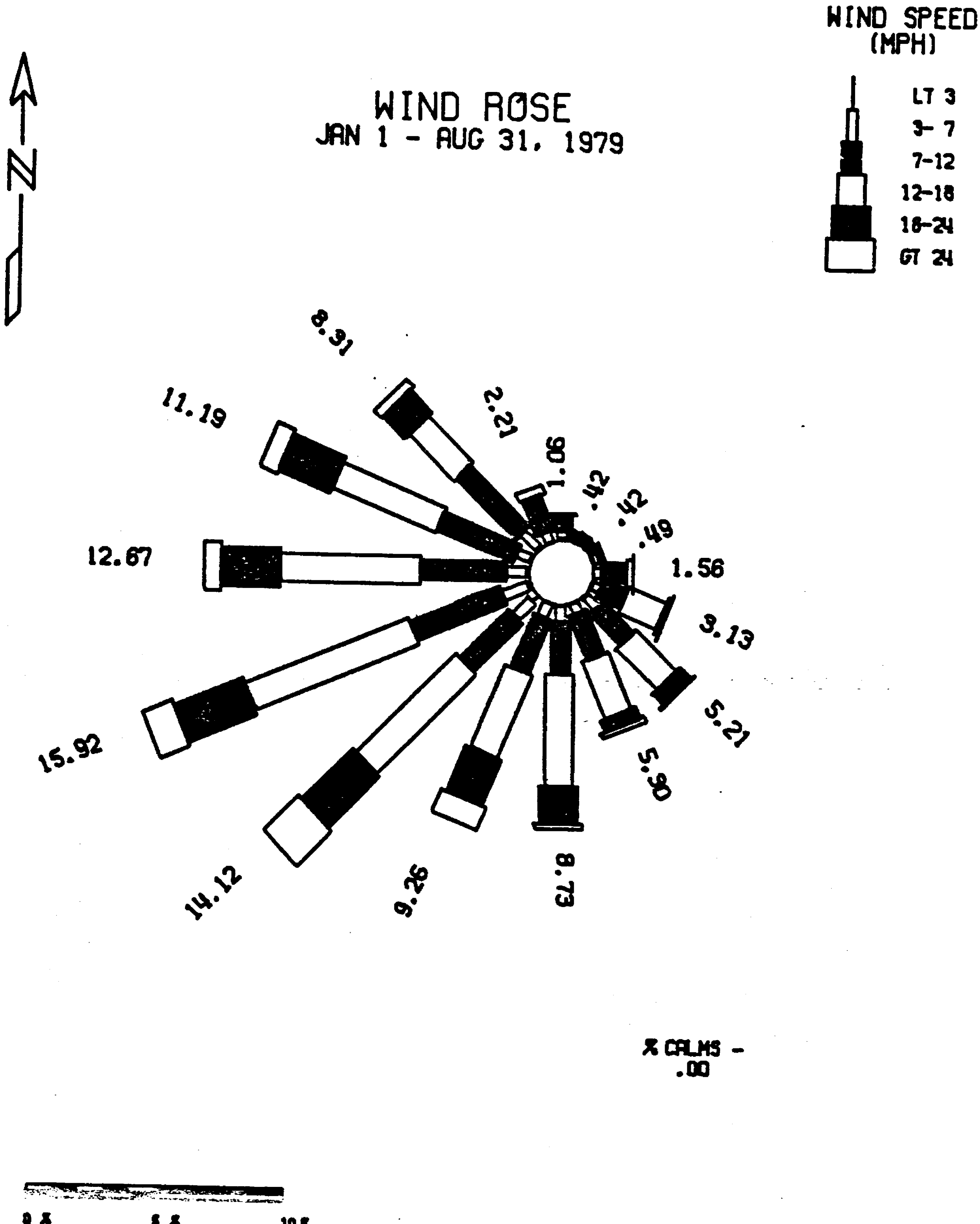

FIGURE V-1

BOARDINGHOUSE PEAK - SITE 040

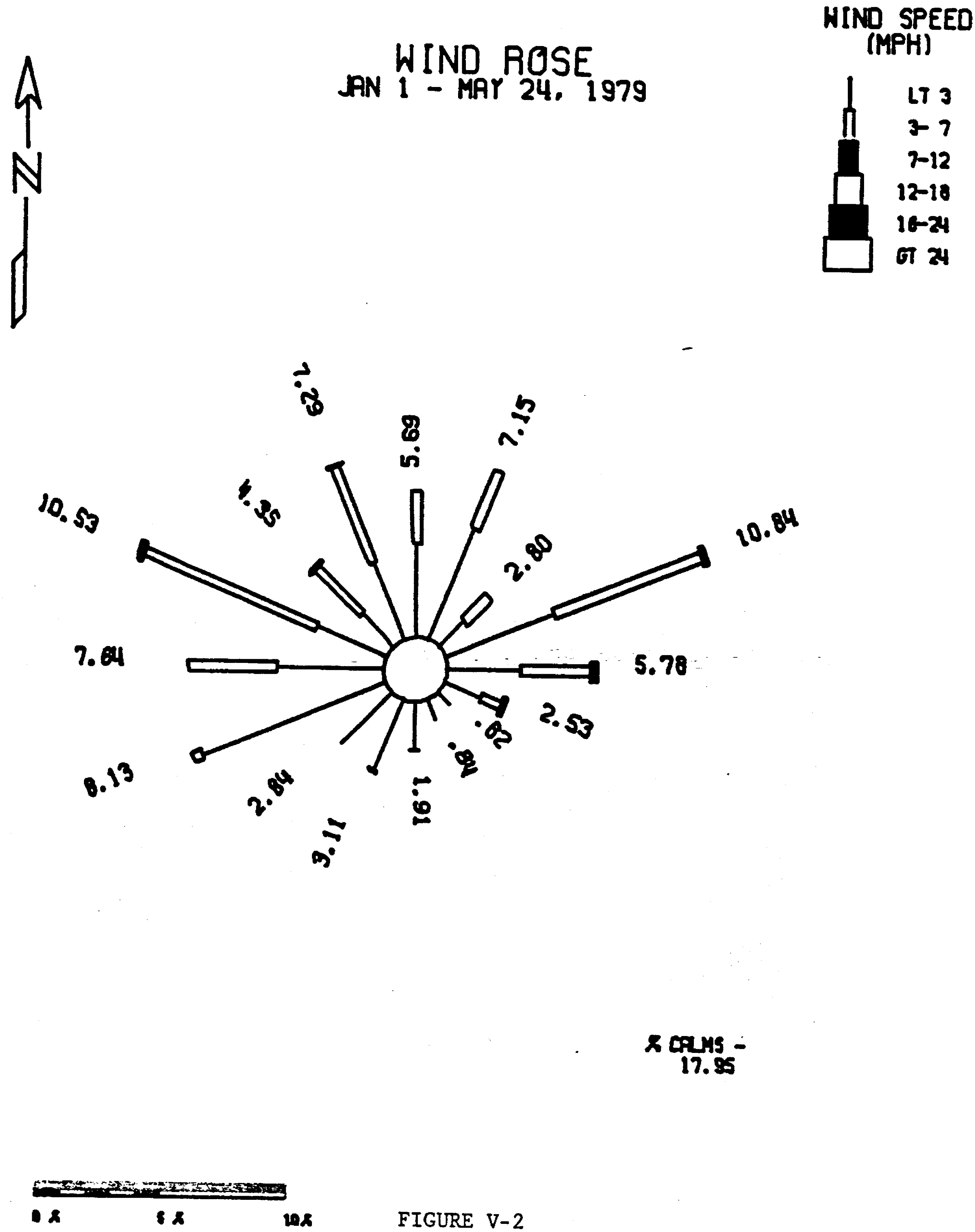

FIGURE V-2

ECCLES CANYON

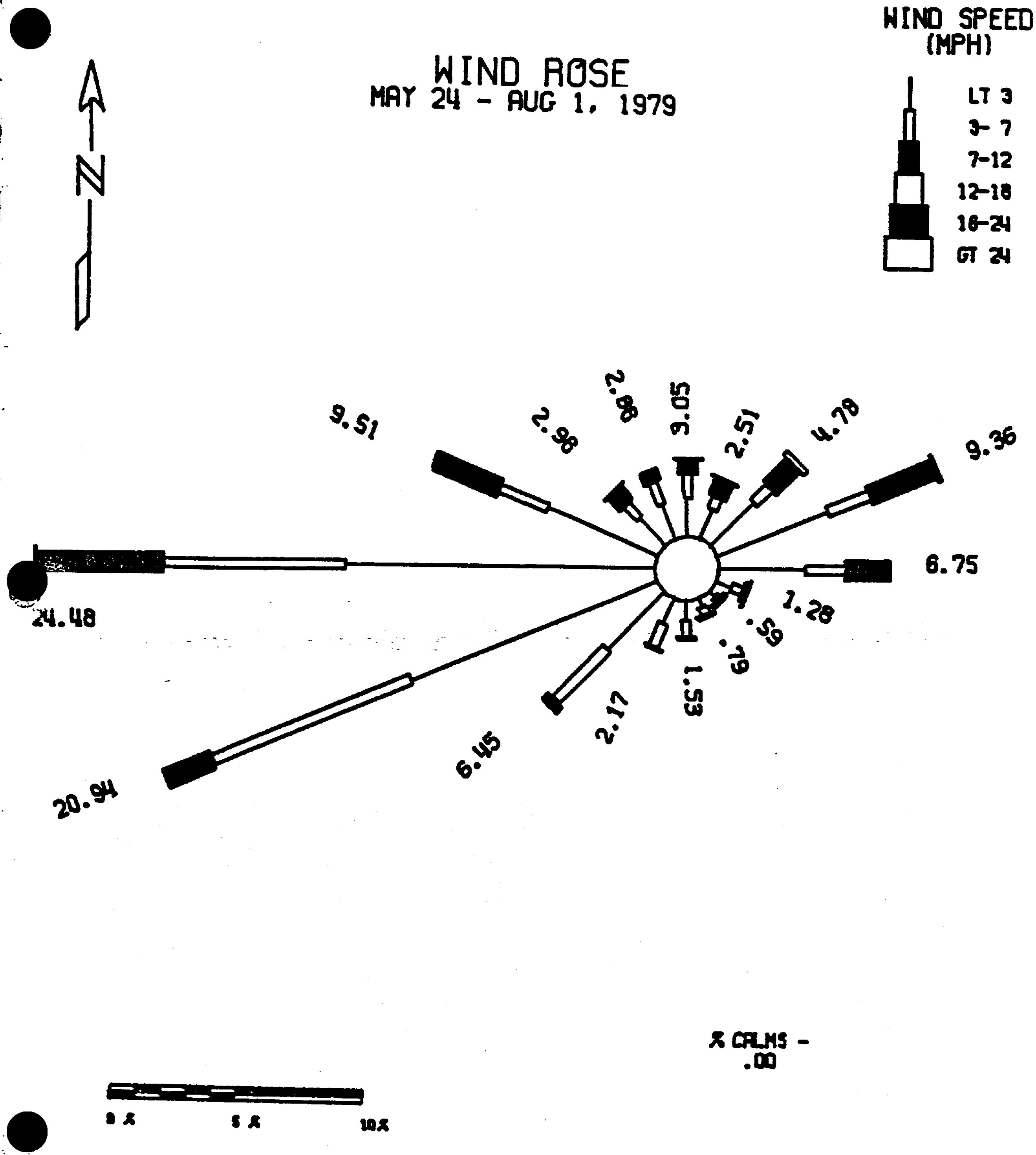

FIGURE V-3

ECCLES CANYON

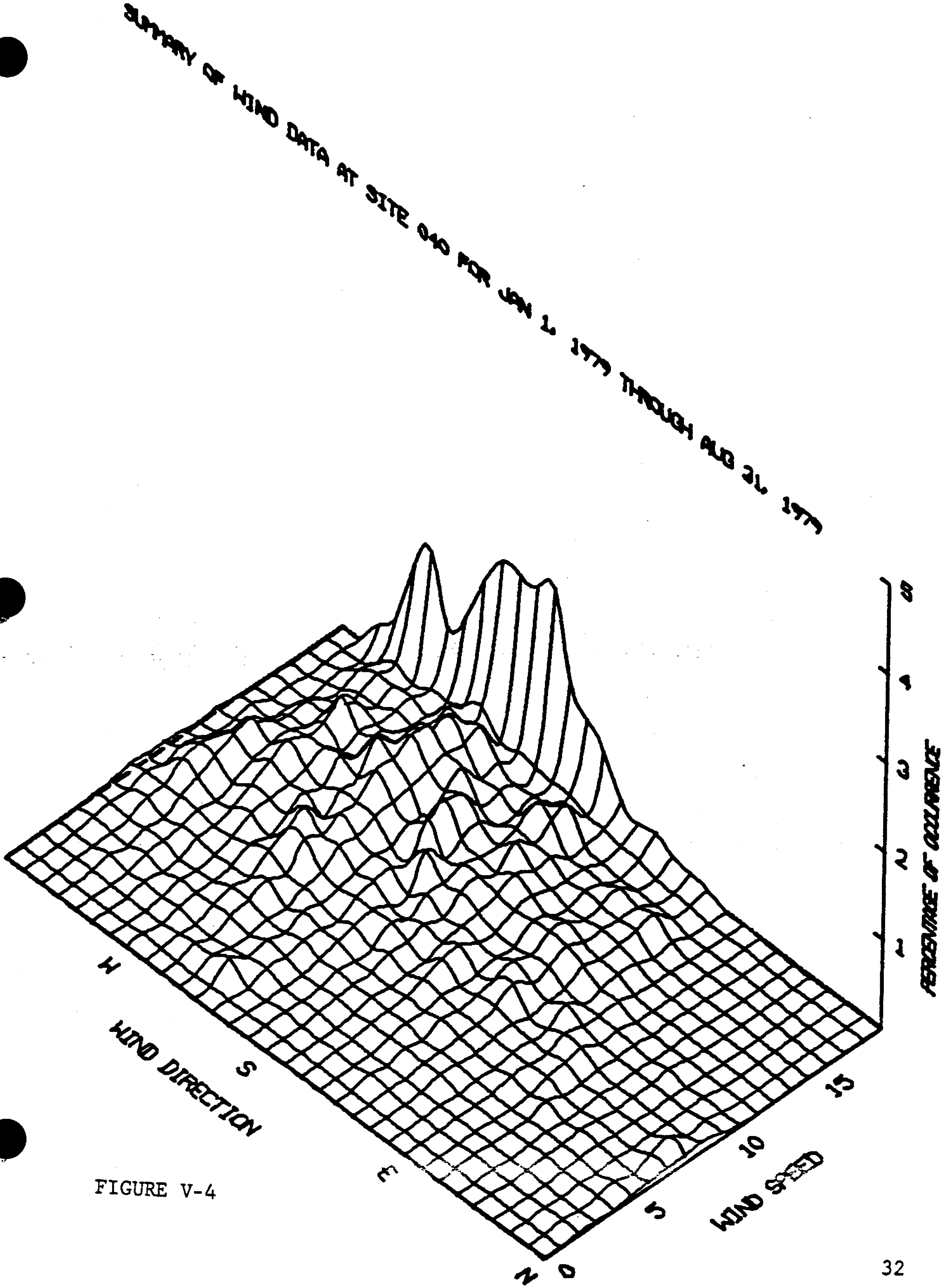
SUMMARY OF WIND DATA AT SITE 040 FOR JAN 1, 1979 THROUGH AUG 21, 1979
PERCENTAGE OF OCCURRENCE
1
2
3
4
WIND DIRECTION
N
E
S
W
WIND SPEED
0
5
10
15

FIGURE V-4

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VI. SPECIAL MONITORING PROGRAMS

In support of the proposed McKinnon mines development effort, Radian Corporation performed several special monitoring programs in addition to the routine monitoring reported in the previous sections. These special programs are discussed in this section.

A. Particulate Monitoring Program

Radian is performing a special, short-term, particulate monitoring program at Eccles Canyon and Clear Creek, Utah. A total of five (5) TSP samples were collected in July at Eccles Canyon near the portal location. A routine sampling program was, also, initiated in July to collect TSP samples on an every-third-day schedule at Clear Creek. This program will continue for approximately five (5) months.

The purpose of this special program is to assess TSP levels near the mine portal site and at Clear Creek and compare these levels with those measured at Boardinghouse Peak. The TSP levels measured near the portal site may provide more representative data than the Boardinghouse Peak or Clear Creek data regarding baseline conditions and the impact of the proposed mining activities on the area.

It should be noted that the Eccles Canyon particulate sampling site does not conform to TSP site selection criteria outlined in Selecting Sites for Monitoring Total Suspended Particulates, Revised, EPA-450/3-77-018, Research Triangle Park, NC, December 1977. Specifically, the TSP monitoring site at the proposed portal location is within 60 feet of the dirt road which follows along the base of Eccles Canyon. Due to the limitations of the rugged terrain, the hi-vol sampler and portable generator could not be separated farther than 60 feet from the dirt road. This road is open in the summer months and although the traffic is light (primarily local hunters) it is nearly certain that the proximity of the dirt road will have a significant effect on measured TSP levels. Despite this deviation from EPA's TSP monitor siting guidelines, it is felt that the Eccles Canyon monitor will provide useful pre-construction ambient data to be compared with ambient levels once the mining operation begins, in accordance with Office of Surface Mining (OSM) monitoring requirements. (This dirt road will be paved once mining operations begin.)

Results of the sampling program at Eccles Canyon and Clear Creek are presented in Tables VI-1 and VI-2, respectively. As noted in Table VI-1, the sample at Eccles Canyon for the 14th was not made during the standard midnight-to-midnight period. The timer mechanism on the sampler malfunctioned and the Hi-Vol did not turn on at midnight. This was discovered by the operator during his morning attendance, and the sampler was started manually at approximately 8:30 a.m. (local time). The sample was continued until 9:25 a.m. on the 15th. Although this sample does not cover a standard EPA-designated run time, the data is included for information purposes.

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TABLE VI-1. DAILY AVERAGES FOR JUL 1 THRU 31 1979

TOTAL SUSPENDED PARTICULATE(UG/M**3)

DATE \ SITE	ECCLES CANYON
Ø7/Ø1	
Ø7/Ø2	
Ø7/Ø3	
Ø7/Ø4	
Ø7/Ø5	
Ø7/Ø6	
Ø7/Ø7	
Ø7/Ø8	
Ø7/Ø9	
Ø7/1Ø	
Ø7/11	
Ø7/12	18Ø.Ø
Ø7/13	
Ø7/14	286.Ø*
Ø7/15	
Ø7/16	179.Ø
Ø7/17	
Ø7/18	
Ø7/19	197.Ø
Ø7/2Ø	
Ø7/21	
Ø7/22	
Ø7/23	
Ø7/24	
Ø7/25	131.Ø
Ø7/26	
Ø7/27	
Ø7/28	
Ø7/29	
Ø7/3Ø	
Ø7/31	
Ø7/Ø1-31	188.5

*This sample not standard 24-Hr run. Run from 8:30 a.m. to 9:25 a.m.

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TABLE VI-2 DAILY AVERAGES FOR JUL 1 THRU AUG 31 1979
SPECIAL PARTICULATE SAMPLING

TOTAL SUSPENDED PARTICULATE(UG/M**3)

SITE / DATE	CLEAR CREEK	SITE / DATE	CLEAR CREEK
07/01		08/01	
07/02		08/02	
07/03		08/03	69.0
07/04		08/04	
07/05		08/05	
07/06		08/06	27.0
07/07		08/07	
07/08		08/08	
07/09		08/09	49.0
07/10		08/10	
07/11		08/11	
07/12	98.0	08/12	19.0
07/13		08/13	
07/14	55.0	08/14	
07/15		08/15	20.0
07/16		08/16	
07/17	57.0	08/17	
07/18		08/18	20.0
07/19		08/19	
07/20	42.0	08/20	
07/21		08/21	40.0
07/22		08/22	
07/23	33.0	08/23	
07/24		08/24	49.0
07/25	65.0	08/25	
07/26		08/26	
07/27		08/27	43.0
07/28	79.0	08/28	
07/29		08/29	
07/30		08/30	34.0
07/31	96.0	08/31	
07/01-31	61.7	08/01-31	33.7

B. Upper-Level Atmospheric Sounding Program at Clear Creek, Utah

Introduction

An upper-level atmospheric pilot balloon sounding program was conducted in the Clear Creek, Utah, area for the purpose of investigating topographical effects on wind flow and temperature in the area and the interrelationships of synoptic patterns and topographical effects. Pilot balloon soundings, from which temperature, wind speed, and wind direction as a function of height are obtained, were conducted from lower Eccles Canyon (at the site of the mechanical weather station) and from Boardinghouse Peak (at the site of the meteorological tower).

Schedule

To obtain data for significantly different atmospheric and land surface conditions, the sounding program was conducted during three periods (April 8-12, 1979; July 3-7, 1979; and September 19-20, 1979). Heavy snow cover and winter-like atmospheric conditions characterized the April sampling period while negligible snow cover and very warm conditions characterized the July period. The September sampling period was characterized by negligible snow cover but somewhat cooler conditions than during the July period.

On each of the sampling days, it was desired that data be obtained at both sites during the morning and afternoon, when dispersion potential is normally weakest and strongest, respectively. Deviations from the planned schedule occurred several times during the April sampling period as a result of poor weather, road, and trail conditions. The September sampling period was reduced to two days because of equipment problems which occurred after arrival in the study area. However, as many runs as possible were conducted during the two day period to provide a set of data which shows changes in atmospheric conditions over relatively short periods of time.

Instrumentation and Methodology

Upper level temperature and pressure measurements were obtained through the use of the following equipment: helium-filled 30-gram pilot balloons, model AS-1B-PT Airsondes from Ambient Analysis, Inc.; the model TS-2A Ground Station Receiver from Ambient Analysis, Inc.; the TS-1A-1-PC Programmable Calculator (a modified HP-97); and the Marantz Superscope audio cassette recorder.

The airsonde, which is attached by a string to the balloon during flight, is a pressure-temperature sensor combined with solid-state electronics in a helicoid propeller-shaped package of molded styrofoam. The temperature sensor (bead thermistor), which has a precision of ±.5°C and resolution of .1°C, is mounted in a radiation shield at the tip of the propeller and is aspirated by its motion. The propeller also slows and stabilizes the descent of the package after the balloon bursts, obviating the need for a parachute. The aneroid capacitance-type pressure sensor has a precision of ±3.0 millibars and a resolution of 1.0 millibar. A crystal-controlled telemetry transmitter transmits on a frequency of 403 MHz. All electronics are powered by a 9V transistor radio battery.

The temperature and pressure signals from the airsonde are received and processed by the ground station receiver. Digital data are displayed on the receiver via light-emitting diodes, and two 25-pin connectors permit transfer of the data to the programmable calculator and to the audio cassette recorder which is used as a backup for the calculator hardcopy (the data can be reread from cassette tape).

The programmable calculator is programmed to receive temperature and pressure data from the receiver, calculate heights through use of the hypsometric equation (temperature and pressure are the inputs for calculating height), and to present on hardcopy temperature as a function of height. The data are processed such that temperature versus height is available for increments of approximately thirty seconds during the balloon flight.

To obtain wind speed and wind direction data with height, the 30-gram balloon is tracked with a single optical theodolite. Measurements of azimuth and elevation angle are obtained every thirty seconds. Since the height of the balloon versus time is known from the calculator printout, there is no need to assume a balloon ascent rate (assumed ascent rates have been found to have limited accuracy). Wind speed and wind direction versus height are computed in-house using simple three-dimensional trigonometry, which requires azimuth and elevation angles, height, and time as inputs to the wind speed and wind direction calculations.

Summary of the April and July Sampling Programs

The following paragraphs summarize the synoptic (large scale) weather conditions which existed during the April and July upper air sampling programs (based on weather charts and the upper air data obtained during the sampling programs), and also summarize the findings of the programs, with emphasis on topographical effects. Data for the September program are currently being processed, and are not included in this report. A discussion of the September sampling program will be included in the final report.

1) Synoptic Weather Conditions During the April and July Sampling Programs

A variety of synoptic weather conditions occurred during the April sampling program, which extended from April 7-12. April 7th and 8th were relatively mild, and skies were cloudless. A strong upper level trough and associated stormy conditions moved into the region on the 9th. Winds became strong southwesterly aloft, and snow showers and squalls began as Pacific moisture flowed into the region. As the upper level trough moved eastward out of Utah on the 10th, winds aloft became strong northwesterly, temperatures fell to very cold levels, and snow showers continued as moisture flowed into the region from the Pacific. This weather pattern changed little on the 11th and 12th.

Upper level weather maps show that, during the July program (July 3-7), a persistent trough was positioned along the Pacific Coast of the United States. The sampling period was characterized by clear to partly cloudy skies on each day but the 3rd, when showers occurred as a pocket of Pacific moisture moved over the area. Temperatures were mild to warm during the period, and not much change occurred from day to day (unlike temperatures during the April sampling period). Wind speeds at and above the level of Boardinghouse Peak were generally moderate. Southeasterly to southwesterly winds occurred near the level of Boardinghouse Peak, while southerly to southwesterly winds prevailed at higher levels.

2) Findings of the April and July Sampling Programs

The following are findings relating to topographical effects on temperature and wind flow and the interrelationships of synoptic patterns and topographical effects, as detected in the April and July sampling data.

- Deep surface-based temperature inversions were detected in Eccles Canyon during several morning pilot balloon runs. These inversion layers ranged in depth from about 100 meters to 500 meters.

- During the July sampling period, when abundant sunshine prevailed, daytime heating was found to result in large increases in temperatures near the surface of Eccles Canyon, while on Boardinghouse Peak, the daytime increase in temperature was relatively small.

- Most of the Eccles Canyon afternoon soundings during the sunny July sampling period showed that, even at heights well above the tops of the canyon walls, temperatures were notably warmer than during the morning at the same levels, indicating that heating of the canyon floor on sunny days influenced temperatures at considerable heights above the canyon floor.

- Daytime up-valley winds in Eccles Canyon, which were typically east-northeasterly, were found to be quite shallow (generally less than 100 meters). With increasing height above the canyon floor, wind directions quickly turned toward the direction of flow at levels above the canyon. While many of the soundings were conducted while daytime up-valley flows were occurring, only one sounding was conducted early enough in the morning for the nocturnal down-valley flow (generally westerly) to still be present. However, the sounding data showed that the down-valley flow was quite shallow, probably less than 100 meters.

- The daytime up-valley flows tended to be over-ridden by the large scale flow over the region and by channeling effects during cloudy conditions and/or when the large scale flow was relatively strong.

- Wind speeds generally increased with height above the floor of Eccles Canyon.

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C. Sound Level Survey

To establish baseline or ambient sound levels in areas that may be affected by development and operation of the proposed McKinnon mines, a sound level survey was performed in July 1979. Results of the survey will establish a basis against which to estimate increase in sound level from the mining activity and resulting impacts if any.

Sound Survey

An octave band sound pressure level (in dB) and sound level (in dBA) survey was performed on consecutive days of July 14, 15, and 16, 1979.

After a reconnaissance of the area, seven locations were identified as measurement points for the survey. These locations are identified in Figure VI-1.

Sound measurements were performed during the following time periods:

Saturday, July 14	7-10 p.m.
Sunday, July 15	10-12 a.m.
	12-7 p.m.
	9 p.m. - 1 a.m.
Monday, July 16	11 a.m. - 1 p.m.
	4-7 p.m.
Tuesday, July 17	4-7 a.m.

At each location several observations were made with the sound level meter. Sound level variations generally at each location were caused by variation in wind speed. It was not

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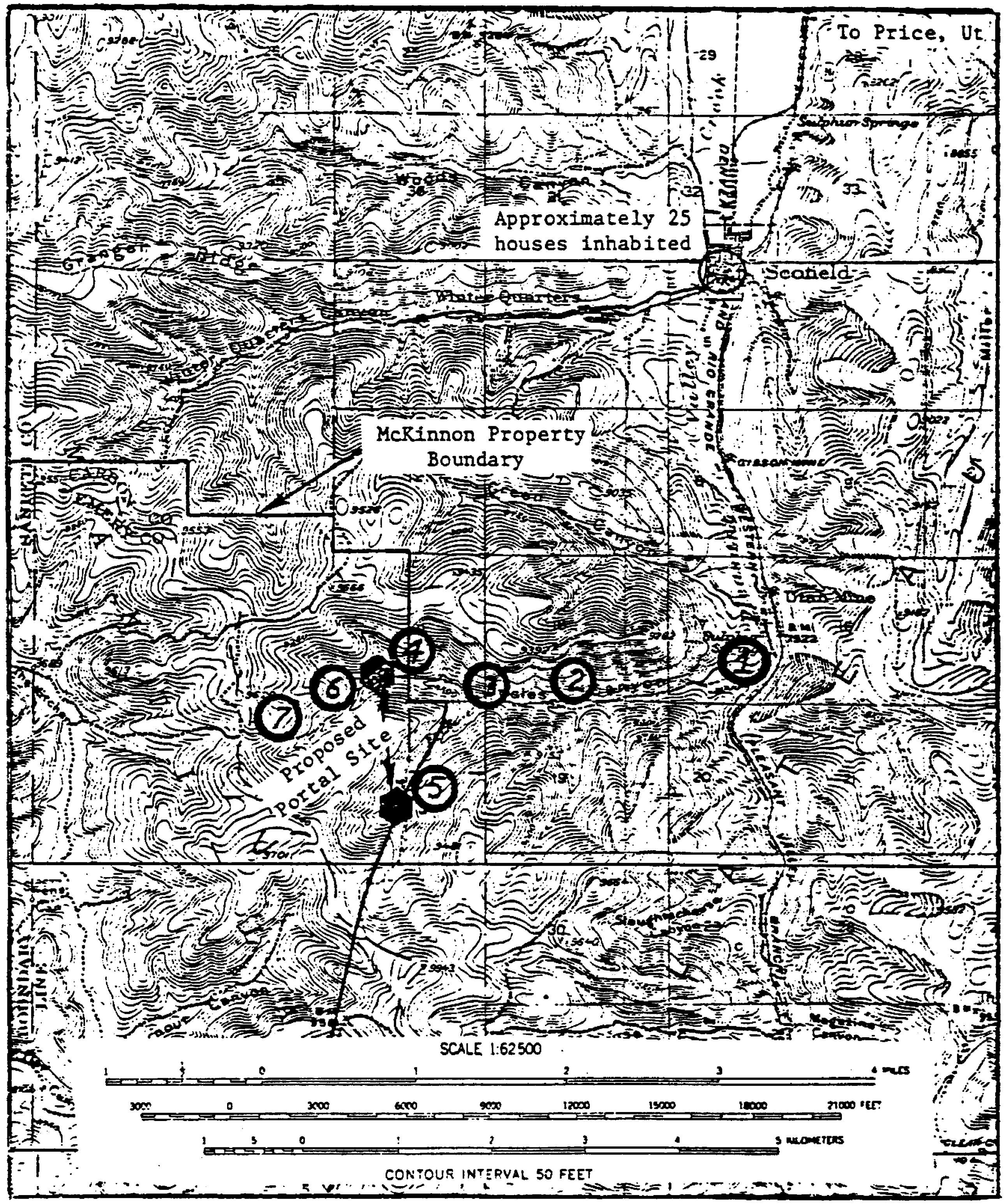

FIGURE VI-1
SOUND MEASUREMENT LOCATIONS

uncommon to observe a 10 dBA variation in level with the wind changing from about 0 mph to 8 mph. At low wind speeds, sound level was quite uniform being dominated by stream noise.

Measurements were performed in accordance with ANSI S1.13-1971, Methods for Measurement of Sound Pressure Levels. The instrumentation used was a Bruel and Kjaer 2209 Octive Band Analyzer. Frequent calibration checks were performed with a Bruel and Kjaer 4220 Piston Phone Calibrator. This instrumentation satisfied the requirements of a Class I Sound Level Meter as specified in ANSI S1.4-1971 Specifications for Sound Level Meters. Standard non-acoustical data, temperature, humidity, wind speed, etc., and extraneous influences were recorded during each measurement period.

Results

Results of the survey are shown in Table VI-3. The values represent an "average" of measurements taken at each location for the period of observation. The measurement values are averages of the meter reading during each measurement. Positions shown in the table are those identified in Figure VI-2.

Sound levels, as shown in Table VI-3, were very uniform at all measurement positions for various daytime and nighttime periods. Major differences between positions were not noted except for positions 6 and 7. These locations reflect the absence of creek noise, the dominant influence near the creeks. The sound levels are typical of those recorded in other wilderness areas of the United States.

To obtain information on the distribution of sound as a function of frequency, octave band sound pressure level

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measurements were performed periodically. Results are shown in Figure VI-2.

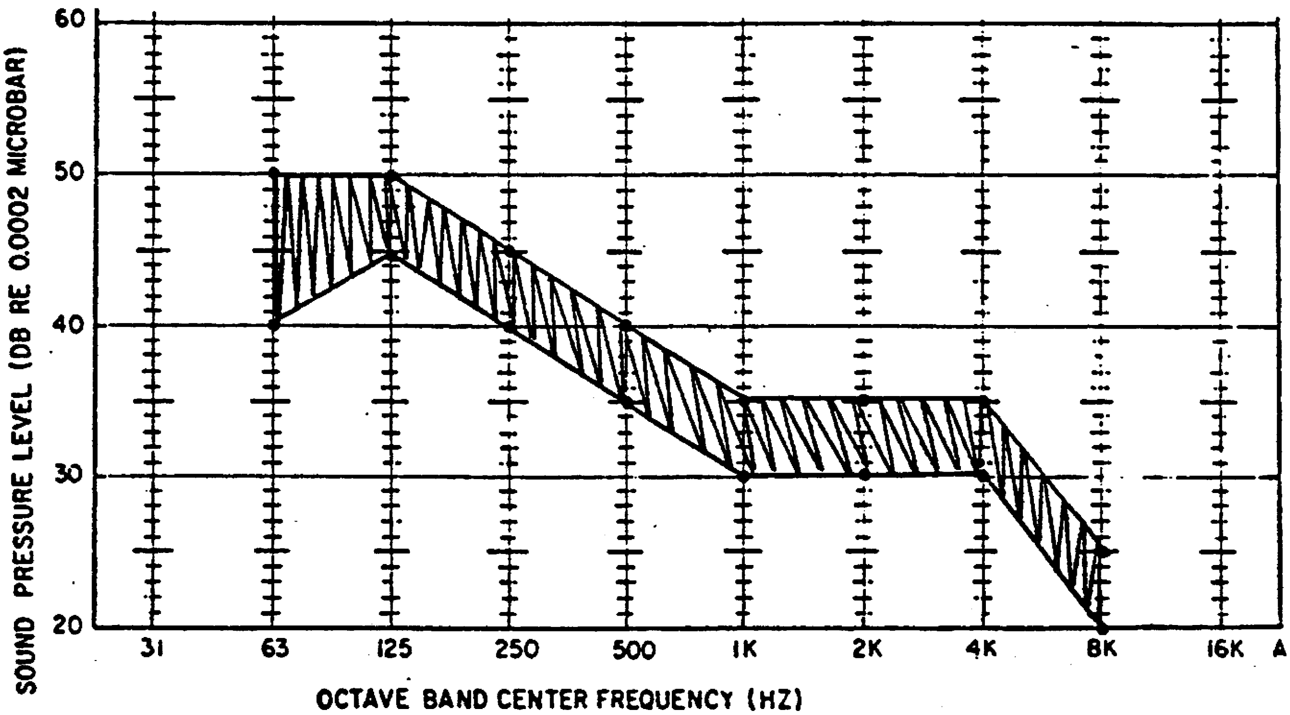

FIGURE VI-2
RANGE OF SOUND PRESSURE LEVEL MEASURED
AT SEVEN DIFFERENT LOCATIONS

Several extraneous noise sources were observed. During Sunday, vehicles (recreational, perhaps, motorcycles) passed through the area at a rate of about one per every fifteen minutes during daylight hours. No attempt was made to measure the influence of these sources as they are highly variable and well documented. Natural sources of sound were from wind-vegetation interaction, creek, birds, and small animals.

During the survey, no trains were observed active on the railroad near Scofield nor was the Utah mine factilities active. As such, no data were collected for these sources.

Observations were made in Scofield to determine the approximate number of residences that were inhabited. It appeared as though about 25 houses were occupied. The other houses appeared to be weekend retreats or transition quarters.

APPENDIX H

VEGETATION AND LAND USE

VEGETATION AND LAND USE
APPENDICES

APPENDIX H
VEGETATION AND LAND USE

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DATA ADEQUACY INFORMATION FOR THE SKYLINE MINE: VEGETATION OF THE WINTERQUARTERS TRACT MT. NEBO SCIENTIFIC, 1992

DATA ADEQUACY INFORMATION
FOR THE SKYLINE MINE:

VEGETATION OF THE WINTERQUARTERS TRACT

Prepared by

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May 14, 1992

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DATA ADEQUACY INFORMATION
FOR THE SKYLINE MINE:

VEGETATION OF THE WINTERQUARTERS TRACT

METHODS

General vegetation mapping was done by using existing information and limited ground truthing techniques. Most of the mapping was done using existing maps and data from range analyses prepared by the USDA Forest Service (Manti-LaSal National Forest, Price, Utah). Maps from nine (9) different grazing allotments were utilized to produce the Winterquarters Tract Vegetation Map that includes a parameter of about .5 miles beyond the tract boundary. The maps from the grazing allotments outlined the general vegetation types i.e. "Timber" and "Browse-Shrub". These types were delineated on a map of the tract area and named more specifically by our experience in the area, quantitative data from the range analyses (1966-77), and limited on-site ground truthing procedures. If the understory or the dominant vegetation types varied by species composition, a more general categorical name was given to the community and described in the "Results" section below.

RESULTS

VEGETATION MAPPING UNITS

A vegetation map of the Winterquarters Tract Area for the Skyline Mine was included in this report. Following is a list with brief descriptions of each vegetation mapping unit that was delineated on the vegetation map.

Aspen

The Aspen community was the most common vegetation type of the Winterquarters Tract Area. Aspen (*Populus tremuloides*) was the dominate overstory species, whereas, depending on the area and environmental variables, snowberry (*Symphoricarpos oreophilis*) or Oregon grape (*Mahonia repens*) were the dominate understory species.

Spruce-Fir

Also important by relative number of acres, were the Spruce-Fir communities of the tract area. These communities were dominated by Engelman spruce (*Picea engelmanii*) and subalpine fir (*Abies lasiocarpa*). Understory varied from relatively little to moderate ground cover, and often was comprised of gooseberry currant (*Ribes montigenum*).

Grasslands

Grassland areas were also mapped in the Winterquarters Tract Area. While they were most commonly dominated by mountain brome (*Bromus carinatus*) or slender wheatgrass (*Elymus trachycaulus*) in the tract area, other species of herbs, grasses and shrubs were also common.

Sagebrush-Grass

The Sagebrush-Grass communities that were mapped were dominated by Vasey sagebrush (*Artemisia tridentata* var. *vaseyana*) and various grass species i.e. slender wheatgrass (*Elymus trachycaulus*) and subalpine needlegrass (*Stipa columbiana*). Other common species of the community were low rabbitbrush (*Chrysothamnus viscidiflorus*), Louisiana sagewort (*Artemisia ludioviciana*), aster (*Aster* spp.), yarrow (*Achillea millefolium*) and Indian paintbrush (*Castilleja* spp.).

Mountain Brush

Mountain Brush communities delineated on the map represented a host of shrubby vegetation types. Most common, however, were probably serviceberry (*Amelanchier utahensis*) and chokecherry (*Prunus virginiana*) communities. Also included in this mapping unit were scrub oak (*Quercus gambelii*) and mountain mahogany (*Cercocarpos montanus*) communities.

Mountain Herblands

Relatively small areas were mapped as herblands. These areas were probably dominated by perennial herb species such as tall larkspur (*Delphinium occidentale*), sticky geranium (*Geranium viscosissimum*) and lupine (*Lupinus argenteus*).

Meadows

Meadows mapped by using the USDA Forest Service Range Analyses were primarily dry meadows comprised of species such as Kentucky bluegrass (*Poa pratensis*) and Ross sedge (*Carex rossii*). The more wet meadows would include species i.e. water sedge (*Carex aquatilus*), Nebraska sedge (*Carex nebraskensis*), and beaked sedge (*Carex rostrata*).

Baren

Baren lands delineated lacked significant vegetative cover. These areas were often rocky or talus slopes and composed relatively small percentages of the tract area.

Riparian Vegetation

Riparian and wetland vegetation was not specifically mapped on the Forest Service range analyses and therefore not mapped on the vegetation map included in this report. There are, however, potential perennial streams in the area. These areas should be specifically mapped if the lease area is pursued and/or potential disturbance to the area exists.

VEGETATION TYPE ACREAGES

Total acreages will be calculated for each vegetation type when the vegetation map is drafted.

FARMLANDS, RANGELANDS, TIMBERLANDS

To date, no farmlands, prime or unique rangelands are known to exist in the area. There is a relatively small area identified by the USDA Forest Service as a potential for timber sales.

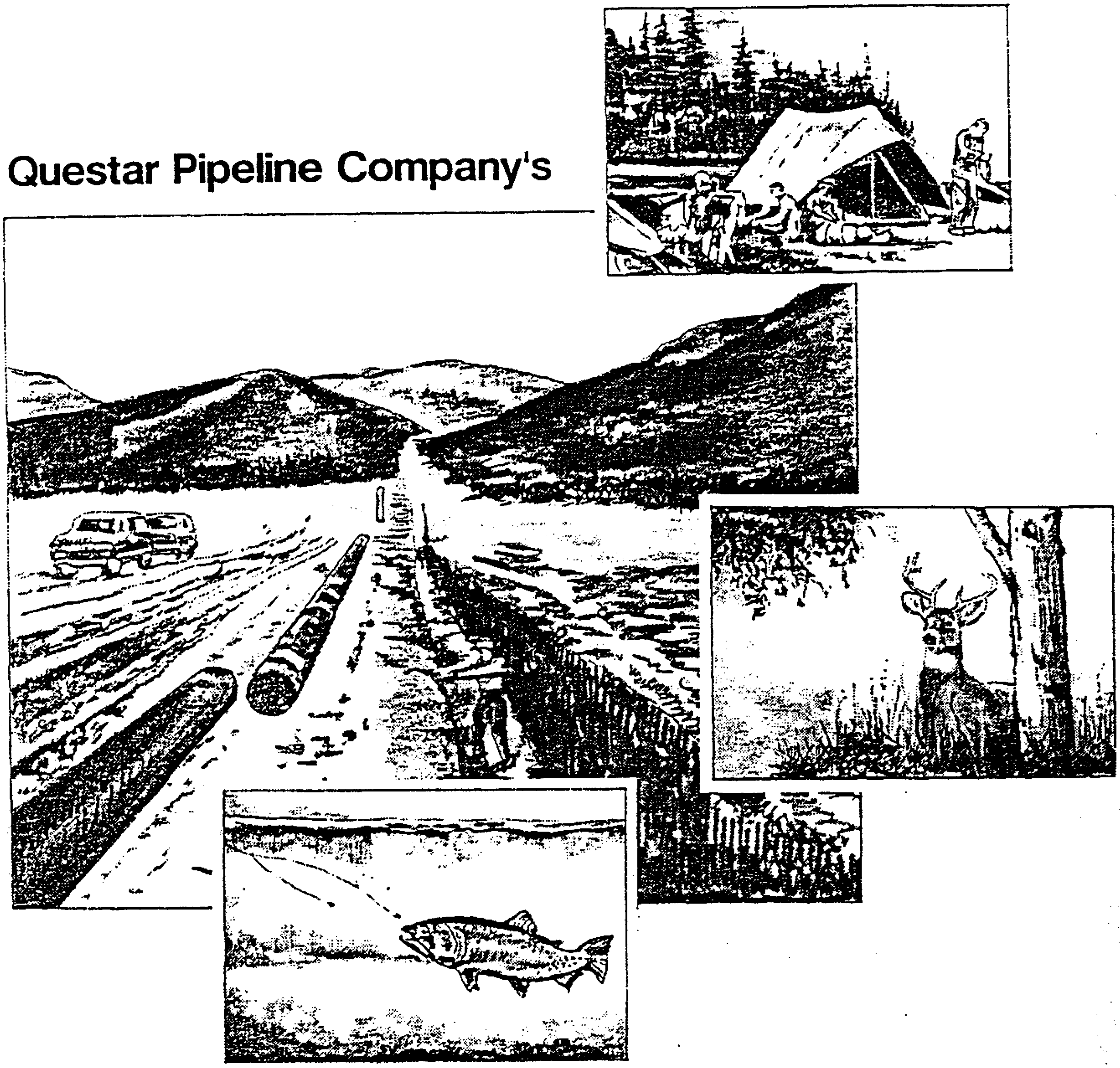
ATTACHMENT TO VEGETATION MAP

Total Areas of Each Vegetation Category

ASPEN	**244,880,000 ft^2**
SPRUCE/FIR	**76,760,000 ft^2**
MOUNTAIN HERBLANDS	**2,480,000 ft^2**
MOUNTAIN GRASSLANDS	**26,920,000 ft^2**
MOUNTAIN BRUSH	**9,840,000 ft^2**
SAGEBRUSH/GRASS	**16,920,000 ft^2**
BARREN LAND	**360,000 ft^2**
MEADOWS	**3,600,000 ft^2**

BIOLOGIC RESOURCES
QUESTAR PIPELINE COMPANY'S
MAIN LINE NO. 41
FINAL ENVIRONMENTAL IMPACT STATEMENT
DAMES & MOORE, 1990

Questar Pipeline Company's



Main Line No. 41
Reroute at Skyline Mine

Final Environmental Impact Statement

US Department of Agriculture
Forest Service, Manti-La Sal National Forest

JULY 1990
Dames & Moore

A number of different biological habitats, each with characteristic plant and animal communities, are present within the project area. There are 4 predominant vegetation types: aspen, mountain shrub, spruce-fir, and riparian (including wet and dry meadows). This section addresses the biological resources in the project area that are most relevant to this project including riparian vegetation, rangeland, timber, aquatic resources, and terrestrial wildlife. No special status species of plants or animals are known to occur in the area.

Biological resources data were obtained from reports, agency contacts, literature review and limited field reconnaissance. Two reports were used extensively. One was prepared by the Western Resource Development Corporation (WRDC) for UCO, Inc. as part of the Scofield Mine Project; the other was prepared by Coastal States Energy Company as part of the Skyline Mine Project.

On October 24, 1989, Dames & Moore personnel visited the project area for the purpose of characterizing the vegetation and estimating the influence of pipeline construction on vegetation and soils of 21 riparian and wetland sites. Also reported were observations on fish and wildlife resources. Information collected during this survey was reported in the document, Report for Questar Pipeline Company's Main Line No. 41 Reroute at Skyline Mine, Riparian Survey, and then incorporated by reference into this EIS.

In addition, on November 7, 1989, biologists from the Utah Division of Wildlife Resources (DWR) and Forest Service conducted an aerial survey to identify locations of raptor nests. The survey results indicated no raptor nesting sites within the proximity of any of the alternative locations.

Riparian/Wetlands

All routes involve crossing or paralleling riparian and associated wetland areas. Riparian and associated wetland areas have very sensitive vegetation and provide important habitat for fish and wildlife.

The riparian meadow and shrubland vegetation type is dominated by perennial grasses, or grass-like plants. Common species include Kentucky bluegrass (*Poa pratensis*), needlegrass (*Stipa* sp.), sedges (*Carex rostrata*), and rush (*Juncus balticus*). Shrubs are also quite common, particularly willow (*Salix* sp.). Other shrubs or woody plants include silver sagebrush (*Artemisia cana*), big sagebrush (*A. tridentata*), and tree species more commonly found in the upland areas (WRDC 1982 and field reconnaissance). Riparian meadow and shrubland vegetation is found in valley bottoms (WRDC 1981). The plant species composition in riparian areas is quite variable and site specific.

The condition of riparian areas was described and rated during the October 24, 1989 site visit. The qualitative ratings were based on several well defined criteria, including (1) the amount of bare ground (percent of vegetative cover), (2) amount of vegetative litter, (3) presence or absence of noxious weeds, (4) species composition of forbs and grasses, and (5) condition of stream bank.

Information regarding these riparian areas is documented in the Biological Resources (pertaining to vegetation, wildlife, and fisheries) and Earth Resources (pertaining to soils and water) sections of this report.

Specific Descriptions

Alternatives A or B - The existing route crosses two riparian areas. Where Segment 19* crosses Mud Creek the vegetation is a mixture of silver sage, grasses, willow, aspen, and Engelmann spruce. The vegetation is in excellent condition, and the site showed no sign of over browsing of woody plants. Segment 12* crosses Gooseberry Creek.

Alternative C - Burnout Canyon Route (1) - High-quality riparian areas exist along this route on Segments 2, 3a, 3b, and 16. Where Segment 3b would cross Burnout Canyon there is a meandering stream. The vegetation here is 85 percent grasses and sedges, 6 percent shrubs, and 5 percent forbs. Some Engelmann spruce grows along portions of the stream. Algae, moss, and liverworts are found on the stream bank. Grasses, woody plants, and forbs are not heavily grazed. This area is in excellent condition.

Riparian areas in Upper Huntington Canyon that parallel Segments 2, 3a, 3b, and 16 consist of about 93 percent grasses and mixed sedges, 5 percent shrubs, and 2 percent forbs. Soils in this area are completely covered by vegetation. Good litter is present throughout the riparian areas. Thick vegetation covers overhanging stream banks and further indicates a high-quality riparian system. The upper end of this reach has drier soils on the western flank so that it supports a stand of big sage and phlox.

The rest of the Burnout Canyon Route segments where pipeline would be constructed are outside of riparian areas.

Alternative C - Burnout Canyon Route (2) - The description of this route is the same as Burnout Canyon Route (1).

Alternative C - Burnout Canyon Route (3) - Some high quality riparian areas exist along this route on Segments 3b (see above) and 24. Segment 24 would cross Swens Canyon, Little Swens Canyon, Upper Huntington Creek, and several small tributaries. Less than 0.4 mile of riparian area would be traversed by Segment 24.

Alternative C - Burnout Canyon Route (4) - The description of this route is the same as Burnout Canyon Route (3).

Alternative D - Gooseberry Route - A high-quality riparian and associated wetland area occurs where the proposed route would cross Gooseberry Creek. This area also contains a pond habitat consisting of dense stands of willows (Salix planifolia) beneath which lies a carpet of dense grass. Ground litter is abundant and well dispersed. Soils in this area are completely covered by vegetation. Fifty percent of the cover consists of willow, 40 percent grass, and 5 percent forbs. Refer to the discussion on the Burnout Canyon Route for information on other segments that are also a part of the Gooseberry Route.

Valley Camp Triangle Connectors (1) through (3) - All segments comprising these connectors would cross within spruce-fir forest, no riparian areas occur along the connectors.

Alternative E - Winter Quarters Route (1) - Where Segment 20 would cross Winter Quarters Creek there is a heavily grazed meadow with no woody plants present. Only two forbs, yarrow (Achillea millifolium) and thistle (Cirsium spp.), are present. Grasses comprise roughly 95 percent of the cover. On the northern fringe of the riparian area is a stand of beaked sedge (Carex rostrata) which makes up the other 5 percent of the plant cover. Two to three inches of water flows through this stand.

Where Segment 20 would cross Pleasant Valley there is a heavily grazed stream-side community. The stream is shallow and about 4 or 5 feet wide. Grasses comprise about 95 percent of the vegetative cover with a mixture of forbs. No woody plants are present at the site.

Segment 21 would parallel Mud Creek north of the town of Clear Creek. Vegetation in this area consists of mixtures of silver sage, willow, grass, aspen, and Engelmann spruce. The side of the stream adjacent to State Route 96 is predominantly a mixture of willow, grasses, and sage. The side of the stream across from the road is characterized by steep, shaded slopes supporting stands of spruce and aspen along some of the stream's length and willow and sage along other portions. These riparian areas are in excellent condition.

Alternative E - Winter Quarters Route (2) - This alternative route would be similar to Winter Quarters Route (1) except Segment 22 was developed to avoid the riparian areas along Segment 21. Segment 22 would cross through mountain shrubland.

Mountain shrubland occurs on all slope aspects. Vasey big sagebrush (Artemisia tridentata ssp. vaseyana) is the most common shrub within this vegetation type. Sage is replaced by mountain snowberry (Symphoricarpos oreophilus) on some north-facing slopes.

Rangeland

Rangeland consists of areas with vegetation that are used for forage by livestock and wildlife. Although all vegetation types of the project area provide some forage, types containing a predominance of grasses and low-shrub species are most suitable. Distinctions between different vegetation types were determined by using the dominant overstory species.

The prevalent range condition on the Manti-La Sal National Forest is fair with no apparent up or downward trend according to the 1986 Final EIS (Forest Service 1986). There are 651,481 acres suitable for livestock grazing in the Manti-La Sal National Forest.

Rangelands of the project area have been inventoried by the Forest Service. They include aspen forest, coniferous forest, mountain shrub, sagebrush types, and wet and dry meadows.

Of the rangelands found in the project area, aspen forest occupies 43 percent, generally on upper elevations of south-facing slopes or recently disturbed sites. Conifer forest generally occupies north-facing slopes and occurs on about 12 percent of the project area (WRDC 1982). Forty-two percent is occupied by the mountain shrub type, which mostly occurs on south-facing slopes. The sagebrush type occurs on about 3 percent of the area in the drier portions of the project area and is generally in the mature stage providing good big-game winter range (Forest Service 1984). Wet and dry meadows occupy a relatively small proportion of the project area (less than one percent). Table 3-4 is a summary of allotments, livestock, and period of use.

Specific Descriptions

Alternatives A or B - The existing pipeline route and area proposed for the surface redundant pipeline cross primarily forested rangeland that consists of conifer timber (spruce-fir) and aspen forest. The existing route (Segments 7*, 10*, and 19*) crosses smaller areas of grassland.

Alternative C - Burnout Canyon Routes (1) through (4) - Rangeland on the Burnout Canyon Routes is comprised primarily of sagebrush, conifer, and aspen. Refer to the riparian section above that describes the riparian habitat type which is used for grazing.

Alternative D - Gooseberry Route - Segment 1 of the proposed Gooseberry Route would cross range types that include sagebrush, aspen, and coniferous forest.

Valley Camp Triangle Connectors (1) through (3) - All segments would pass through aspen and coniferous forest-dominated rangeland.

Alternative E - Winter Quarters Route (1) - This route would cross rangelands that include a mix of aspen and coniferous forest at the upper elevations (e.g., Segments 22 and 20), and sagebrush at the lower elevations. Areas of wet and dry meadows are prominent in the area where Segment 20 would cross the Mud Creek Valley south of Scofield.

Alternative E - Winter Quarters Route (2) - This description of this alternative route is the same as Winter Quarters Route (1) except areas of wet and dry meadows are prominent in the area along Segment 21 that occurs in the Mud Creek Valley.

Timber

Spruce-fir forest is dominated by subalpine fir (Abies lasiocarpas). Other tree species are Engelmann spruce (Picea engelmannii), aspen (Populus tremuloides), and some Douglas-fir (Psuedotsuga menziesii). Common shrub and subshrub species include Saskatoon serviceberry (Amelanchier alnifolia), Oregon-grape (Mahonia repens), boxwood (Pachistima myrsinites), mallow ninebark (Physocarpus malvaceus), wood's rose (Rosa woodsii), and mountain snowberry (Symphoricarpos oreophilus).

TABLE 3-4
SUMMARY OF ALLOTMENTS, LIVESTOCK, AND USE

Route/Allotment	Livestock		Period of Use	
Existing Routes (A or B)				
Burnout S&G[1]	942		7/1 - 9/25	
Eccles S&G	800		7/1 - 9/30	
North Winter Quarters S&G	459		7/1 - 9/30	
East Gooseberry S&G	1,014	**	7/1 - 10/10	
Mansion S&G	999	**	7/1 - 10/10	
Cabin Hollow S&G	1,050		7/1 - 9/30	
"C" Canyon S&G*	1,250		7/1 - 9/30	
	6,514			
Burnout Canyon Routes				
Burnout S&G	942		7/1 - 9/25	
Eccles S&G	800		7/1 - 9/30	
Swen's Canyon S&G*	959		7/1 - 9/30	
North Winter Quarters S&G*	459		7/1 - 9/30	(variable season)
East Gooseberry S&G	1,014	**	7/1 - 10/10	
Mansion S&G	999	**	7/1 - 10/10	
Cabin Hollow S&G	1,050		7/1 - 9/30	
"C" Canyon S&G*	1,250		7/1 - 9/30	
	7,473			
Gooseberry Routes				
Burnout S&G	942		7/1 - 9/25	
Swen's Canyon S&G	959		7/1 - 9/30	
Beaver Dams S&G	1,100		7/6 - 10/05	
Fairview C&H	500		7/1 - 9/30	
Cabin Hallow S&G	1050		7/1 - 9/30	
South San Pitch S&G*	600		7/6 - 9/30	
"C" Canyon S&G	1,250		7/1 - 9/30	
	6,401			
Winter Quarters Routes				
Granger Ridge S&G	1156		7/1 - 9/30	
North Winter Quarters S&G	459		7/1 - 9/30	
East Gooseberry S&G	1,014	**	7/1 - 10/10	
Mansion S&G	999	**	7/1 - 10/10	
Cabin Hollow S&G	1,050		7/1 - 9/30	
"C" Canyon S&G	1,250		7/1 - 9/30	
	5,928			

Table 3-4 (continued)
Summary of Allotments, Livestock, and Use

Route/Allotment	Livestock	Period of Use
Unknown private land use		

1 S&G = sheep allotment
C&H = cattle allotment
* Adjacent allotments to the proposed Burnout Canyon Route (2) and (4)
** Includes private land permit

Spruce-fir (Picea engelmannii and Abies lasiocarpas) forest tends to occur on the north-facing slopes and in protected portions of small tributary drainages within the study area. The aspen (Populus tremuloides) forest is a successional stage to spruce-fir forest, except for marginal stands on south-facing slopes. The north, east, and west slopes show an understory of spruce-fir leading to eventual conifer dominance in these areas (WRDC 1982).

Spruce-fir and aspen sites occur predominantly along most of the proposed routes. Some routes cross timber sites planned for future harvest of sawtimber (trees greater or equal to 8 inches DBH (diameter at breast height)) and pole timber (trees 5 to 7.9 inches DBH) product size classes.

Generally, mixed conifer forests are in age classes where susceptibility to insects and diseases is high. The Engelmann spruce bark beetle is of particular concern because of its potential to attack and kill Engelmann spruce. Beetle populations are currently endemic.

Timber occurs in varying amounts on all the routes under consideration. However, not all of the area has been inventoried, and timber volumes are projected from data of 2 representative spruce-fir and 1 aspen site that were inventoried in 1982 and 1984 (Jackson 1990). The sites are located near Segments 3b and 14 of the Burnout Canyon Route. The following data indicate the ranges of timber volume (gross board feet or cubic feet per acre) that could be anticipated in spruce-fir and aspen timber sites:

Spruce-fir Sites

Sawtimber	Gross Volume (board feet per acre)
Live mixed conifer	
Engelmann spruce - subalpine fir	12,620 - 15,880
Dead mixed conifer	1,650 - 2,430
Live aspen	780 - 960
Dead aspen	210

Pole Timber	Gross Volume (cubic feet per acre)
Live mixed conifer	44 - 1559
Dead mixed conifer	56 - 57
Live aspen	22

Aspen Sites

Sawtimber	Gross Volume (board feet per acre)
Live aspen	10,180
Dead aspen	210
Live mixed conifer	3,890
Dead mixed conifer	380

Pole Timber	Gross Volume (cubic feet per acre)
Live aspen	48
Dead aspen	70

The timber volumes listed above for spruce-fir and aspen sites are shown by route on Tables 3-5 and 3-6. Volumes of pole timber have been converted from cubic feet to thousand board feet (MBF) in the tables for comparison.

Specific Descriptions

Alternatives A or B - Although the existing route passes through stands of timber (both aspen and spruce-fir forest sites) there are no trees on the existing right-of-way.

Alternative C - Burnout Canyon Route (1) - This route would cross stands of aspen forest sites (approximately 1.9 mile) and spruce-fir forest sites (1.6 miles), which represent a total of approximately 424 thousand board feet (mbf).

Alternative C - Burnout Canyon Route (2) - This route would cross through aspen forest sites (1.9 miles) and spruce-fir forest sites (1.5 miles), which represent a total of approximately 410.6 mbf.

Alternative C - Burnout Canyon Route (3) - This route would be the same as Burnout Canyon Route (1).

Alternative C - Burnout Canyon Route (4) - This route would be the same as Burnout Canyon Route (2).

Alternative D - Gooseberry Route - the Gooseberry Route would cross through about 4.4 miles of spruce forest sites and 1.9 miles of aspen forest sites, which represent a total of approximately 816.4 mbf.

Valley Camp Triangle Connectors (1) and (2) - These connectors would cross spruce-fir forest sites (0.9 mile), which represent a total of approximately 127 mbf.

Valley Camp Triangle Connector (3) - This connector would cross spruce-fir forest sites (0.5 mile), which represent a total of approximately 71.1 mbf.

Alternative E - Winter Quarters Route (1) - This route would cross spruce-fir forest sites (3.5 miles) and aspen forest sites (1.1 miles), which represent a total of approximately 607 mbf. Associated Segments 19* and 23* have no trees in the right-of-way.

Alternative E - Winter Quarters Route (2) - This route would cross spruce-fir forest sites (3.4 miles) and aspen forest sites (3.2 miles), which represent a total of approximately 811.9 mbf. Associated Segments 19* and 23* have no trees in the right-of-way.

TABLE 3-5
TIMBER VOLUMES BY ROUTE
SPRUCE-FIR SITES

ROUTE	ACRES	SAWTIMBER CONIFER LIVE	SAWTIMBER CONIFER DEAD	SAWTIMBER ASPEN LIVE	SAWTIMBER ASPEN DEAD	POLE TIMBER CONIFER LIVE	POLE TIMBER CONIFER DEAD	POLE TIMBER ASPEN LIVE
AVERAGE BOARD FEET per ACRE		14,250	2,040	870	210	802	57	22
AVERAGE CUBIC FEET per ACRE								
Alternative A	-	-	-	-	-	-	-	-
Alternative B	-	-	-	-	-	-	-	-
Alternative C								
Burnout Canyon Route								
(1)	11.7	166.7	23.9	10.2	2.5	46.9	3.3	1.3
(2)	11.0	156.8	22.4	9.6	2.3	44.1	3.1	1.2
(3)	11.7	166.7	23.9	10.2	2.5	46.9	3.3	1.3
(4)	11.0	156.8	22.4	9.6	2.3	44.1	3.1	1.2
Alternative D								
Gooseberry Route	32.1	457.4	65.5	27.9	6.7	128.7	9.1	3.5
Valley Camp Triangle Connectors								
(1)	6.6	94.1	13.5	5.7	1.4	26.5	1.9	0.7
(2)	6.6	94.1	13.5	5.7	1.4	26.5	1.9	0.7
(3)	3.7	52.7	7.5	3.2	0.8	14.8	1.1	0.4
Alternative E								
Winter Quarters Route *								
(1)	25.6	364.8	52.2	22.3	5.4	102.7	7.3	2.8
(with Segments 19* & 23*)		364.8	52.2	22.3	5.4	102.7	7.3	2.8
(2)	24.8	353.4	50.6	21.6	5.2	99.4	7.1	2.7
(with Segment 19*)		353.4	50.6	21.6	5.2	99.4	7.1	2.7

* Associated Segments 19* and 23* have no trees in the right-of-way.

TABLE 3-6
ASPEN SITES

ROUTE	ACRES	SAWTIMBER ASPEN LIVE	SAWTIMBER ASPEN DEAD	SAWTIMBER CONIFER LIVE	SAWTIMBER CONIFER DEAD	POLE TIMBER ASPEN LIVE	POLE TIMBER ASPEN DEAD
AVERAGE BOARD FEET per ACRE		10,180	210	3,890	380		
AVERAGE CUBIC FEET per ACRE						48	70
Alternative A	-	-	-	-	-	-	-
Alternative B	-	-	-	-	-	-	-
Alternative C							
Burnout Canyon Route (1)	13.9	141.5	2.9	54.1	5.3	3.3	4.9
(2)	13.9	141.5	2.9	54.1	5.3	3.3	4.9
(3)	13.9	141.5	2.9	54.1	5.3	3.3	4.9
(4)	13.9	141.5	2.9	54.1	5.3	3.3	4.9
Alternative D Gooseberry Route	13.9	141.5	2.9	54.1	5.3	3.3	4.9
Valley Camp Triangle Connectors							
(1)	-	-	-	-	-	-	-
(2)	-	-	-	-	-	-	-
(3)	-	-	-	-	-	-	-
Alternative E							
Winter Quarters Route * (1)	8.0	81.4	1.7	31.1	3.0	1.9	2.8
(with Segments 19* & 23*)		81.4	1.7	31.1	3.0	1.9	2.8
(2)	23.4	238.2	4.9	91.0	8.9	5.6	8.2
(with Segment 19*)		238.2	4.9	91.0	8.9	5.6	8.2

* Associated Segments 19* and 23* have no trees in the right-of-way.

Aquatic Resources

Early in the scoping process, the Forest Service and DWR expressed particular concern for the Yellowstone cutthroat trout (Oncorhynchus clarki lewisi) fisheries of Upper Huntington Creek. The DWR plans to use Upper Huntington Creek as the Yellowstone cutthroat trout egg source for Utah. In addition to the Yellowstone cutthroat trout, the Forest Service has identified species of benthic macroinvertebrates within Upper Huntington Creek, which, by their habitat preference, indicate that this stream is capable of supporting a self-sustaining resident fishery. Issues identified at the August 30, 1989 scoping meeting focused on the potential effects of pipeline construction on riparian vegetation and water quality along Upper Huntington Creek, which, could in turn, adversely affect fish and wildlife habitat.

Yellowstone cutthroat trout and mottled sculpins (Cuttos bairdi) are found in every perennial drainage within the project area and are dependent on healthy riparian systems for their survival. In addition, rainbow trout, mountain sucker (Catostomus platy rhynchus), and redside shiners (Richardsonius balteatus) reside in the Fish Creek drainage below Lower Gooseberry Reservoir and in Lower Gooseberry Creek. Redside shiner and mountain sucker reside in the creeks in Winter Quarters and Broads Canyon.

Burnout Canyon Creek and Upper Huntington Creek are used exclusively as spawning and rearing streams by the Yellowstone cutthroat trout spawners coming out of Electric Lake. This creek is closed to fishing during spawning season, and is probably not fished significantly after it opens July 1 because most spawners have migrated back to Electric Lake.

Gooseberry Reservoir is stocked annually with 12,000 catchable rainbow trout. Creel census data show that 10 percent of the fish caught are wild Yellowstone cutthroat trout. The cutthroat trout run up Gooseberry Creek and spawn in the spring. It is estimated that Lower Gooseberry Reservoir receives approximately 2,200 Fishermen User Days (FUDs) per year (one FUD = 12 angling hours). The annual value of this fishery is approximately $102,652.

Scofield Reservoir is one of Utah's most heavily fished reservoirs. Spawning trout from Scofield Reservoir, including both rainbow trout and cutthroat trout, migrate up Mud Creek to spawn. Scofield Reservoir receives approximately 27,000 FUDs and is stocked with 600,000 3-inch rainbow trout annually.

The DWR initiated a study in 1987 to evaluate Upper Huntington Creek as a potential egg source to replace Strawberry Reservoir which may be poisoned in the fall of 1990 to eliminate trash fish. The DWR is in the third year of a 3-year study to certify Electric Lake cutthroat trout as disease free so they can begin taking eggs. The DWR conducted a fishery survey in 1987 and determined that 2,629 spawners migrated up Upper Huntington Creek carrying a total of 1,629,045 eggs.

As is typical with most cutthroat trout species, the Yellowstone cutthroat trout begins to spawn during the spring, when water temperatures approach 50 degrees Fahrenheit, and usually continues through mid-June. The fertilized eggs incubate in the gravel through July with the "hatched" fry usually swimming up from the gravel by late August but this can occur as late as mid-September depending on water temperature.

Upper Huntington Creek is by far the most important spawning tributary to Electric Lake. It is estimated that 66 percent of the spawners in Electric Lake spawn in Upper Huntington Creek or its tributaries. Creel census data collected in 1985 (May to October) show that anglers spend a total of 24,314 hours fishing Electric Lake each year. These data were collected prior to the implementation to year-round fishing. It is estimated that this figure should be increased by 5,000 hours to include early spring fishing, late fall fishing, and winter ice fishing. The total of these two figures equals 2,443 FUDs per year. The annual value of the Electric Lake fishery is estimated to be $127,231 (i.e., $52.08 per FUD - 1990 dollars).

The DWR plans to take 1 million eggs from Upper Huntington Creek to meet the annual statewide demand of 600,000 fry. These eggs are worth approximately $11,000. FUD's occur mainly in Electric Lake, but they are the result of spawning that takes place in Upper Huntington Creek. It is estimated that $108,147 in FUD's can be attributed to Upper Huntington Creek for a total fishery value of $119,147. The value of the fishery will increase dramatically when the DWR begins stocking other reservoirs and lakes with fry hatched from eggs taken from Upper Huntington Creek.

Specific Descriptions

Alternatives A and B - The existing route crosses Mud Creek (Segment 19*) and Gooseberry Creek (Segment 12*), both important habitat for fish. The areas of unstable slopes along Segment 12* result in some sedimentation to Gooseberry Creek and eventually to Lower Gooseberry Reservoir.

Alternative C - Burnout Canyon Routes (1) and (2) - Either variation of this alternative would generally parallel Upper Huntington Creek and would cross the creek at 9 locations. The stream is sensitive as it is considered the most important tributary to Electric Lake for Yellowstone cutthroat trout spawning. The stream in Burnout Canyon would be crossed at one location.

Alternative C - Burnout Canyon Routes (3) and (4) - Either variation of this alternative would cross the creek in Burnout Canyon (Segment 3b), cross Upper Huntington Creek and Highway 264, parallel Highway 264 on the west side, cross Swens Canyon Creek, then would cross Upper Huntington Creek at Little Swens Canyon south of The Kitchen (Segment 24).

Terrestrial Wildlife

Emphasis is placed on riparian areas likely to be affected by pipeline construction and maintenance. Riparian areas clearly provide the most important fish and wildlife habitat in the project area. Riparian areas in the region are generally designated by the DWR as important big game winter habitat.

Riparian areas provide habitat for several species of furbearers including beaver (Castor canadensis), muskrat (Ondatra zibethicus), and raccoon (Procyon lotor) (Coastal States Energy Company 1981; WRDC 1981). Many species of small mammals, birds, and amphibians are completely dependent on riparian areas for their existence.

Other habitat types are also important to wildlife. Upland-shrub and sage-brush habitat types provide important summer forage for mule deer and elk, while forested areas provide important cover. The study area provides yearlong habitat for blue grouse (Dendragapus obscurus) and ruffed grouse (Bonasus umbellus). Blue grouse use conifer-aspen-meadow mosaics on ridgetops and concentrate in spruce-fir forest in the winter. Ruffed grouse use a wide range of habitat types with aspen forest providing critical habitat during crucial mid-winter months (DWR 1981; WRDC 1981).

Specific Descriptions

Alternatives A and B - The existing route crosses 2 riparian areas. Where Segment 19* crosses Mud Creek the vegetation is important habitat for big game. This area is in excellent condition; there is no sign of over browsing of woody plants. Segment 12* crosses Gooseberry Creek, which is also important wildlife habitat. Most of these routes pass through mountain shrubland habitat. The remainder of the routes lie in aspen forest or spruce-fir forest habitats.

Alternative C - Burnout Canyon Routes (1) and (2) - The high-quality riparian habitat areas that exist along this route on Segments 2, 3a, 3b, and 16 in conjunction with adjacent aspen stands provide important big game habitat and cover. Segments 23* and 19* cross through aspen. Of the 2 routes, Burnout Canyon Route (1) would cross the least riparian habitat.

Alternative C - Burnout Canyon Route (3) and (4) - This route would lie mostly outside of riparian areas. Segment 24, which replaces 3a, 2 and 16, would be situated in Mountain Shrubland vegetation. This vegetation provides important summer forage for elk and [illegible] Highway 264.

habitat areas that would be crossed by Segment 20 are of greatly diminished value to wildlife due to overgrazing and proximity to residential areas. Associated Segments 19* and 23* cross through aspen.

Alternative E - Winter Quarters Route (2) - The description of this route is the same as Winter Quarters Route (1) except Segment 21 (instead of Segment 22) would parallel and twice cross Mud Creek north of the town of Clear Creek. These riparian areas are in excellent condition for wildlife habitat. Associated Segment 19* crosses through aspen.

Special Status Species

No listed Threatened or Endangered plant species are known to occur within the project area. This conclusion is based on past surveys, information provided by agency personnel and literature reviews. Threatened or Endangered species are those listed by the U.S. Fish and Wildlife Service (USFWS). Sensitive species are those species that are candidates for Federal listing or proposed for Federal listing by the USFWS.

One sensitive species, Hymenoxys helenioides, a Federal candidate plant for listing (Category 2) is known to occur in the Scofield Reservoir region, and may occur within the project area (Thompson 1989). This species is described as occurring in mountain brush, sagebrush and aspen communities, often in meadows between 8,000 feet and 9,800 feet in Emery, Garfield, Sanpete and Sevier counties in Utah (Rutman 1989). Prior to construction, the Forest Service botanist will field-check any areas along the selected route where the plant could possibly occur.

No Threatened, Endangered or Sensitive faunal species or their habitats are known to reside within the study area. Threatened or Endangered species that may occur seasonally within the study area are the American peregrine falcon (Falco peregrinus anatum), arctic peregrine falcon (Falco peregrinus), and bald eagle (Haliaeetus leucocephalus). Bald eagles are known to occur in the study area as winter migrants. Two mature bald eagles were seen near the Gooseberry Route during the raptor survey conducted by the DWR during November 1989. Sightings of bald eagles are typical in the project area from November through March (Dalton 1989). Peregrine falcons are most likely to occur in the study area as rare spring and/or fall transients. Black-footed ferret (Mustela nigripes), an endangered species, might be found in the Wasatch Plateau east of the study area (Dalton et al. 1978). The possibility of this species occurring on the study area is remote (Coastal States Energy Company 1981).

RECREATION

Developed recreation sites and dispersed recreation areas on the Manti-La Sal National Forest draw visitors from around the state. The Forest Service provides numerous opportunities to experience a "semi-primitive" recreation setting, in addition to providing developed recreation facilities. Further, the Scofield Lake State Recreation Area provides other water-based recreation opportunities. Though dispersed recreation occurs throughout the project area, the majority of use occurs in Forest management units that may provide semi-primitive recreation and emphasize undeveloped motorized recreation sites. In addition to these management units, semi-primitive recreation occurs in management units that emphasize other uses. Many of these units contain areas classified by the Recreation Opportunity Spectrum (ROS) as semi-primitive motorized (SPM) and semi-primitive non-motorized (SPNM). ROS is a system developed by the Forest Service to integrate recreation values into National Forest Plans, project designs, and management decisions.

The ROS class of SPNM recreation occurs in the study area within the SPR management unit that emphasizes semi-primitive recreation. However, this management unit is not crossed by any of the proposed pipeline routing alternatives. The utility corridor management unit, the existing route, bounds this semi-primitive recreation management unit.

Two management units that emphasize undeveloped motorized recreation sites are located within the project area--one in the vicinity of Gooseberry Creek, the other around Lower Gooseberry Reservoir. Gooseberry Campground has a capacity of 100 PAOT (persons at one time) with a usage of about 3,000 RVDs (recreation visitor days). Undeveloped recreation usage around Lower Gooseberry Reservoir is about 6,250 RVDs. Activities include watersports, fishing, off-road vehicle use, and primitive camping. Developed recreation sites are largely centered around the reservoirs and creeks. Generally, recreation activities include fishing, hunting, hiking, biking, camping, picnicking, cross-country skiing, boating, snowmobiling, and off-road vehicle use.

The Fish Creek National Recreation Trail would not be crossed directly by any of the proposed routes segments; however, two connecting access trails would be crossed by Segment 12*. State Highway 264 is a proposed National Scenic Byway. Skyline Drive is part of the basic planning corridor for the future development of the Great Western Trail. Usage along Skyline Drive is about 7,000 RVDs. Skyline Drive passes near dispersed rural residences on private lands and is also a proposed scenic backway, a designation for unpaved roads on public lands (Federal) designed to encourage recreational uses. Additionally, Skyline Drive is part of the Utah Adventure Highway System, a series of interpretive scenic routes that wind through Utah's National Forests past points of scenic geologic interest, cultural features, and recreation areas.

Specific Descriptions

Alternatives A and B - Segments 7*, 10*, 17*, and 18* parallel a recreation access road. Segment 13* passes adjacent to the site of a proposed campground (Crooked) and parallels a recreation access road. A connecting trail that provides access to the Fish Creek National Recreation Trail is crossed by Segment 12*. This segment also crosses an area with a ROS class of SPM recreation. Segments 19* and 23* are not adjacent to or do not cross any recreation uses.

Alternative C - Burnout Canyon Route (1) - Segments 12*, 13*, 19* and 23* are part of the existing route (see description for Alternatives A and B). Segments 3a, 3b, and 14 would cross areas with a ROS class of SPM recreation. Segment 14 also would pass adjacent to a proposed campground (Crooked). Segments 2 and 16 and a small portion of Segment 3 would parallel Upper Huntington Creek. Also, Segments 2, 3b, and 16 would parallel State Highway 264, which is used by recreationists. A connecting trail that provides access to the Fish Creek National Recreation Trail is crossed by Segment 12*. This segment also crosses an area with a ROS class of SPM recreation.

Alternative C - Burnout Canyon Route (2) - This route uses the same segments as described in the preceding route description, except Segment 14 is replaced by Segments 15 and 17*. Segment 17* is part of the existing route. Segment 15 would cross an area with a ROS class of SPM recreation.

Alternative C - Burnout Canyon Route (3) - Refer to description for Burnout Canyon Route (1) above. Segment 24 would parallel State Highway 264.

Alternative C - Burnout Canyon Route (4) - Refer to description for Burnout Canyon Route (2) above. Segment 24 would parallel State Highway 264.

Alternative D - Gooseberry Route - Segments 19* and 23* are not adjacent to or do not cross any recreation uses. Approximately 1 mile of Utah Highway 264 would be paralleled by portions of Segments 2 and 3 in Upper Huntington Canyon. Segment 3 would cross an area with a ROS class of SPM recreation. Segment 2 and a small portion of Segment 3b would parallel Upper Huntington Creek. Segment 1 would parallel Skyline Drive, a gravel road moderately travelled by recreationists and residents.

Two areas with a ROS class of SPM recreation would be crossed by Segment 1. Segment 1 would also pass near Gooseberry Campground in a Forest management unit that emphasizes undeveloped motorized recreation sites in the vicinity of Gooseberry Creek. This segment also would pass near a private church camp located in Little Swens Canyon.

Valley Camp Triangle Connectors (1) through (3) - Segments 7* and 10*, part of the existing route, parallel a recreation access road. Segment 5/6 also would parallel a recreation access road and would pass adjacent to an area with a ROS class of SPM recreation. Segment 8 would not be adjacent to or would not cross any recreation uses. Both Segments 4 and 9 would parallel a recreation access road.

Alternative E - Winter Quarters Route (1) - A connecting trail that provides access to the Fish Creek National Recreation Trail is crossed by Segment 12*. This segment also crosses an area with a ROS class of SPM recreation. Segments 20 and 22 would cross private lands that are not available for public recreation. A portion of this route would parallel State Highway 96, used to reach recreation areas. Associated Segments 19* and 23* are not adjacent to or do not cross any recreation uses.

Alternative E - Winter Quarters Route (2) - Segment 23* is part of the existing route and is not adjacent to or does not cross any recreation uses. Refer to the preceding route description for Segment 12*. Most of Segment 20 would cross private lands that are not available for public recreation. The portion of this segment on National Forest System lands would cross through the edge of an area with a ROS class of SPM recreation and would pass adjacent to a proposed campground (Dry Creek). A portion of this route would parallel Utah Highway 96, used to reach recreation areas. Associated Segment 19* is not adjacent to or does not cross any recreation uses.

Riparian/Wetlands

There is a potential for adverse impacts where proposed routes cross or parallel sensitive riparian and associated wetland areas. The most likely locations for long-term adverse impacts are where Segment 1 would cross Gooseberry Creek and Segments 2 and 16 would parallel or cross Upper Huntington Creek. In general, long-term adverse impacts are avoidable and no net loss of wetlands would occur if appropriate mitigation measures are applied.

Specific Descriptions

Alternative A - No-Action - This alternative would create no effect on vegetation in the project area as no surface resources would be disturbed.

Alternative B - Leave in Place, Full Extraction Mining - If complete coal extraction is allowed and a redundant pipeline is constructed on the surface, some minimal disturbance to vegetation (and habitat) would be anticipated.

Alternative C - Burnout Canyon Routes (1) and (2) - Segments 2, 3a, 3b, and 16 have potential for direct effects on riparian areas. Segment 3b would cross the Burnout Canyon stream channel at 1 location. The pipeline could be installed with minimum impact.

Segments 2 and 16 would parallel Upper Huntington Creek. Riparian vegetation would be impacted nearly the entire length of Upper Huntington Canyon. At 9 locations the pipeline would cross the stream channel or come into direct contact with it. The pipeline would be buried at, or near, ground water level, and if piping occurs, the ground water level could be changed, thereby changing the riparian habitat. Extreme caution during construction would be required to protect this highly sensitive area. No new impacts to riparian vegetation would occur along Segments 19* and 23*.

Alternative C - Burnout Canyon Route (3) and (4) - This route differs from Burnout Canyon Routes (1) and (2) in that Segment 24 replaces Segments 3a, 2, and 16, thereby avoiding most of the potential impacts to riparian areas described for these routes. Segment 24 would cross Upper Huntington Creek northwest of the confluence with Little Swens Canyon and several small tributaries. At these locations, extreme caution during construction would be required as described above.

Alternative D - Gooseberry Route - Segment 1 would cross Gooseberry Creek at a particularly sensitive area with regard to riparian habitats. The alignment as originally identified would cross the stream channel and potentially impact a pond. However, it has been recommended that the alignment of the route be modified upstream or downstream to avoid this area.

See the preceding discussion on the Burnout Canyon Route regarding Segments 2, 3a, 3b, 19*, and 23*, which are also part of the Gooseberry Route.

Valley Camp Triangle Connectors (1) through (3) - The majority of these routes would be located in dense coniferous forest. There are no riparian habitats.

Alternative E - Winter Quarters Route (1) - Segment 20 would cross Winter Quarters Creek and Mud Creek in Pleasant Valley. The area has been heavily disturbed and, thus, additional disturbance is considered to be a minor impact. Segment 22 would avoid the Mud Creek riparian area, therefore Winter Quarters Route (1) would have less potential impact to riparian habitat than Winter Quarters Route (2).

Alternative E - Winter Quarters Route (2) - Refer to description of Segment 20 above. Segment 21 would parallel Mud Creek north of the town of Clear Creek. These riparian areas are in excellent condition. With proper revegetation, long-term adverse effects on the riparian area could be avoided.

Rangeland

Grazing use would be impacted from several project-related activities. Clearing of the rights-of-way would reduce the amount of forage available until the area is again revegetated. Construction activity would disrupt normal use patterns in some areas, thereby reducing grazing use on a short-term basis. The magnitude of such impacts would depend on time of construction and the specific right-of-way alignment in the various allotments.

Impacts would also occur by grazing-revegetation interactions, whereby successful revegetation may take a longer period and require reseeding if heavily grazed. Conversely, grazing use reduction could occur if restrictions (e.g., fencing) are required to reduce livestock pressure on revegetated areas.

The use of livestock restriction measures should be done on a cooperative basis between the project proponent and the Forest Service livestock operator for each allotment to help reduce these impacts.

Alternative A - No-Action - Alternative A would have little impact on existing rangeland resources that occur on the right-of-way, except for the opportunity to improve range on some areas of the right-of-way through revegetation.

Alternative B - Leave in Place, Full Extraction Mining - Construction of a redundant surface pipeline could interrupt livestock use of some areas during construction operations. Construction could affect 11.8 animal unit months (AUMs). Construction during the July 1 to September 30 use period could affect normal use patterns. Minor impacts to existing forage would occur during construction and operations of the pipeline, but only a small area in the existing right-of-way would be affected.

Alternative C - Burnout Canyon Routes - Construction could affect approximately 13.0 AUMs along Burnout Canyon Routes (1) and (3) and 13.2 AUMs along Burnout Canyon

Routes (2) and (4). Sheep grazing could be affected by construction activities if this occurs during the July 1 to September 30 use period. Rangeland use would also be affected if barriers are needed to keep sheep from revegetated right-of-way until plants are well established.

Alternative D - Gooseberry Route - The Gooseberry Route would cross a relatively large amount of range. Construction could affect 14.6 AUMs. Numerous grazing permittees could be affected by the project during construction and the establishment period of revegetated species. Impacts from construction activities, in addition to direct loss of forage by right-of-way clearance, could change historic use patterns if they occur during the use period. As discussed previously, protection of the revegetated right-of-way from grazing would reduce the amount of grazing acreage available and could reduce livestock access.

Valley Camp Triangle Connectors (1) through (3) - Most of the area of these routes consists of dense coniferous forest and aspen-rangeland, and grazing resources are minimal. The exception occurs in Valley Camp Triangle Connector (1), which contains sagebrush rangeland. Thus, impacts from right-of-way clearing and pipeline construction are considered to be low. Construction could affect 0.9 AUMs along Connector (1), 0.8 AUMs along Connector (2), and 0.4 AUMs along Connector (3).

Alternative E - Winter Quarters Routes - Impacts to grazing would include loss of forage from right-of-way clearance, change in use patterns during construction, and reduction in usable acreage and access by potential restriction of livestock from reclaimed areas. Impacts were rated as low, however, due to short duration and the opportunity to improve the grazing resource through reclamation. Construction could affect 14.1 AUMs along Winter Quarters Route (1) and 15 AUMs along Winter Quarters Route (2). No additional AUMs would be affected along associated Segments 19* or 23*.

Timber

Potential timber volume (gross) losses are summarized in Tables 3-5 and 3-6 using a 60-foot pipeline right-of-way width, the timber volumes for typical spruce-fir and aspen forest sites, and the distance that spruce-fir and aspen forest would be crossed by each alternative of the various routes.

For any reroute, reestablishing existing timber volumes would be long term (over 100 years). With successful reforestation, reestablishment of wood-fiber production would be short term (5 to 10 years). Some of the impacts would be offset by selling merchantable timber and fuelwood. The Federal government would receive the revenue from selling the timber and fuelwood that would be used for various products and, as an economic benefit, 25 percent of all timber receipts would go to the respective counties.

Alternative A - No-Action - No impacts to timber resources are anticipated if the existing route is retained.

Alternative B - Leave in Place, Full Extraction Mining - The construction of a surface redundant pipeline could cause minor impacts in some areas only if timber is cleared for construction access. Such impacts are considered to be minor, but long-term.

Alternative C - Burnout Canyon Routes - Right-of-way clearance would affect approximately 424 thousand board feet (mbf) of timber resources along Burnout Canyon Routes (1) and (3) and 410.6 mbf along Burnout Canyon Routes (2) and (4).

Alternative D - Gooseberry Route - Right-of-way clearance would affect approximately 816.4 mbf of live timber resources.

Valley Camp Triangle Connectors (1) through (3) - Spruce-fir forests occur on almost the entire length of each segment. Right-of-way clearance could affect 127 mbf along Connectors (1) and (2), and 71.1 mbf along Connector (3).

Alternative E - Winter Quarters Routes (1) and (2) - Spruce-fir and aspen timber is especially prominent at the higher elevations of these routes. Right-of-way clearance could affect approximately 607 mbf along Winter Quarters Route (1) and 811.9 mbf along Winter Quarters Route (2). There is no timber within the existing right-of-way of associated Segments 19* and 23*.

Aquatic Resources

For any of the alternative reroutes, minimal impacts to spawning habitat would occur in 1990 as construction would be allowed only after fry have left the gravel. However, future-year classes would be adversely affected since some sediment would be generated that would not wash into the reservoirs for years to come. Artificial flushing flows can be accomplished to remove sediment below reservoirs, but not above reservoirs as is the case with this project. (Estimated "worst-case" sediment yield is summarized on Table 4-5 in the Water Resources section above.)

During the years the pipeline would be in use, operation and maintenance of the pipeline would not be expected to affect aquatic ecosystems except in the unlikely event of a pipeline rupture. Should a pipeline rupture occur beneath or immediately adjacent to a stream, impacts to aquatic organics related to this disturbance would be confined to the area immediately surrounding the rupture. Natural gas is highly insoluble in water and would vent to the atmosphere.

The criteria for determining impacts for this analysis are listed below. It was assumed that all unstable areas proximal to streams would be avoided; all streams potentially affected in the project area have on-site fisheries or are immediately upstream of fisheries; the stream below each stream crossing would be impacted for about 0.5 mile; and cumulative impacts from 2 stream crossings, but on different streams (i.e., Winter Quarters Creek and Mud Creek near the Town of Scofield), raises the impact to the next higher level.

High impact - if the pipeline alignment is within 50 feet of a perennial stream at numerous locations and crosses the stream at more than 4 locations per stream mile.

Moderate-to-high impact - if the pipeline alignment is within 50 feet of a perennial stream at numerous locations and crosses the stream between 2 and 4 locations per stream mile.

Moderate impact - if the pipeline alignment is within 50 feet of a perennial stream at numerous locations and crosses the stream only at one location.

Low-to-moderate impact - if the pipeline alignment occasionally is within 50 feet of a perennial stream, but does not cross the stream or the pipeline alignment crosses the stream perpendicularly at one location.

Low impact - if the pipeline alignment occasionally is within an area 50 to 150 feet of a perennial stream, but does not cross the stream.

No identifiable impact - if the pipeline alignment is farther than 150 feet from a perennial stream.

Specific Descriptions

Alternative A - No-Action - Existing impacts occur in the areas of unstable land along Segment 12*. However, there would be no effect on fish from this project as no surface resources would be disturbed. Low to moderate impacts over 0.5 mile are presently occurring at the existing Gooseberry Creek crossing.

Alternative B - Leave in Place, Full Extraction Mining - There would be no effect on fish in the project area as the redundant pipeline would not cross any streams. Low to moderate impacts over 0.5 mile are presently occurring at the existing Gooseberry Creek crossing.

Alternative C - Burnout Canyon Routes (1) and (2) - These routes would cross the stream channel in Burnout Canyon at 1 location. Along the 0.4 mile of stream between this crossing and Electric Lake, moderate impacts could occur to fisheries due to increased sediment. The route also would parallel Upper Huntington Creek and cross the stream at 9 locations. Potential sedimentation along the 2.2 miles of the route (or 3.0 stream miles) between the uppermost stream crossing and Electric Lake could result in moderate-to-high impact to fisheries. Extreme caution during construction would be required to minimize impacts to Yellowstone cutthroat trout and mottled sculpin habitat, and of sedimentation to spawning gravels.

Alternative C - Burnout Canyon Route (3) and (4) - These routes would cross the stream channel in Burnout Canyon in 1 location. Along the 0.4 mile of stream between this crossing and Electric Lake, moderate impacts could occur to fisheries due to increased sediment. These routes would cross Upper Huntington Creek in 2 locations and could result in moderate to high impacts (1.0 mile total). Extreme caution during construction would be required to minimize impacts to Yellowstone cutthroat trout and mottled sculpin habitat, and of sedimentation to spawning gravels.

Alternative D - Gooseberry Route - Originally, the alignment of Segment 1 crossed a sensitive pond area on Gooseberry Creek that could have been destroyed or damaged by construction. However, to mitigate the potential impacts, the alignment would be moved to avoid the ponds. The crossing of Gooseberry Creek would result in low-to-moderate impacts to fisheries for approximately 0.5 mile downstream from the crossing. Segment 2 and part of Segment 3 would parallel and cross Upper Huntington Creek northwest of the confluence with Little Swens Canyon where resulting impacts would be moderate-to-high between the uppermost crossing and Electric Lake (1.4 miles). Segment 3 also would cross the stream channel in Burnout Canyon at one location where resulting impacts between the crossing and Electric Lake would be moderate (0.4 mile).

Valley Camp Triangle Connectors (1) through (3) - There would be no effects to fisheries along any of the Connectors.

Alternative E - Winter Quarters Route (1) and (2) - Yellowstone cutthroat trout, rainbow trout, and mottled sculpin inhabit Mud Creek and Winter Quarters Creek and spawning habitat would be impacted at and below the stream crossing south of Scofield (Segment 20). The Winter Quarters Creek crossing would result in low-to-moderate impacts to the fisheries in the lower 0.4 mile of the creek. The Mud Creek crossing near the town of Scofield would result in low-to-moderate impacts to the fisheries in the 0.1 mile between the creek crossing and the confluence of Winter Quarters Creek. Cumulative, moderate impacts would result in 0.4 mile of Mud Creek below the confluence with Winter Quarters Creek. There is presently 0.5 mile of low-to-moderate impacts from the existing crossing at Gooseberry Creek. Along Segment 21, the new pipeline would cross Broads Canyon Creek. The crossing would result in low-to-moderate impacts for the 0.2 mile between the crossing and Mud Creek. Also, Segment 21 would parallel and cross Mud Creek at 2 locations north of the town of Clear Creek. Construction activities along and crossings of Mud Creek would result in low-to-moderate impacts to fisheries. No impacts would occur along associated Segments 19* or 23*.

There would be no moderate to high impacts along either route. Winter Quarters Route (1) could result in 0.5 mile of moderate impacts and 1.0 mile of low impacts. Winter Quarters Route (2) could result in 2.8 miles of moderate impacts and 2.1 miles of low to moderate impacts.

Terrestrial Resources

There is a high potential for adverse impacts where the pipeline routes would cross or parallel sensitive riparian areas and streams. Short-term loss of plant productivity could adversely effect important big game winter habitat. Long-term adverse impacts could be avoidable along other portions of the route if appropriate mitigation measures are taken. The most likely areas of adverse impact would be where Segment 1 would cross Gooseberry Creek and Segments 2 and 16 would parallel Upper Huntington Creek, Segment 20 would cross Mud Creek, Segment 21 would parallel Mud Creek, and Segment 3a would cross Upper Huntington Creek.

Specific Descriptions

Alternative A - No-Action - This alternative would create no effect on wildlife in the project area as no surface resources would be disturbed.

Alternative B - Leave in Place, Full Extraction Mining - Some disturbance to wildlife habitat would be anticipated, if the redundant pipeline is constructed.

Alternative C - Burnout Canyon Route (1) - Segments 2, 3a, 3b, and 16 have potential for direct adverse effects on riparian areas, important wildlife habitat. Moderate-to-high short-term impacts to a total of approximately 3.3 miles of riparian habitat could result from construction. Segments 2 and 16 parallel Upper Huntington Creek. Careful construction practices would be employed to minimize degradation of big game winter habitat.

Alternative C - Burnout Canyon Route (2) - Impacts are the same as Burnout Canyon Route (1).

Alternative C - Burnout Canyon Route (3) - This route would have less impact on riparian habitat than Burnout Canyon Routes (1) and (2). Some summer forage for elk and mule deer would be temporarily lost.

Alternative C - Burnout Canyon Route (4) - Impacts are the same as Burnout Canyon Route (3).

Alternative D - Gooseberry Route - Segment 1 crosses Gooseberry Creek at a particularly sensitive area (moderate-to-high impacts) with regard to wildlife habitat. The short-term loss of willow production could adversely impact big game winter range habitat.

Valley Camp Triangle Route Connectors (1) through (3) - There would be no identifiable effect to wildlife resources along the Connectors.

Alternative E - Winter Quarters Route (1) - Winter Quarters and Mud Creek riparian habitat crossed by Segment 20 are of greatly diminished value to wildlife due to overgrazing and their proximity to residential areas. Low-to-moderate impacts could result. Segment 22 would avoid the Mud Creek riparian area. During a recent survey for raptors conducted by the Utah Division of Wildlife Resources three nests were located along this route. The closest nest to the proposed alignment is about 0.8 mile. The terrain and forest vegetation should protect the inhabitants of this nest during construction (Dalton 1989).

Alternative E - Winter Quarters Route (2) - Impacts along Segment 20 are discussed under Winter Quarters Route (1). Segment 21 parallels Mud Creek north of the town of Clear Creek. These riparian areas are in excellent condition. Impacts could be moderate to high.

Special Status Species

No special status species of plants or animals, known to occur in the project area, would be affected. One sensitive species (Hymenoxys helenioides), a Federal candidate plant for listing, may occur in the project area. Prior to construction, the Forest Service botanist will field-check any areas along the selected route where the plant could possibly occur.

RECREATION

The experience of solitude and freedom sought by many recreation users of the National Forest would be disturbed during the construction of the pipeline in any new right-of-way. These disturbances are expected to be short-term, during and immediately following construction. Careful construction followed by aggressive rehabilitation measures are expected to minimize the remaining evidence of construction disturbance. Temporary delays to area traffic would occur, but roads would not close. The following are descriptions of the potential impacts to recreation by each alternative route. Refer to Table 4-6 for specific mileages.

Alternative A - No-Action - Recreation uses would not be affected further.

Alternative B - Leave in Place, Full Extraction Mining - Construction of a section of surface pipeline along Segments 7*, 10*, 17* and 18* in areas with ROS class of SPM recreation would diminish considerably the quality of the outdoor experience expected by visitors. Other segments of this route would not affect recreation.

Alternative C - Burnout Canyon Route (1) - Segments 12*, 13*, 19* and 23* are part of the existing route and would have no further impact on recreation. Segments 3a, 3b, and 14 would reduce the recreation experience for users that encounter disturbance along these segments in remote areas. Segment 14 may become an undesirable intrusion to future recreation users of the proposed campground (Crooked). However, construction of the campground is not anticipated until after the year 2030. Segments 2, 16, 3a and a small portion of Segment 3b would have moderate impacts to the experience sought by recreation users fishing along Upper Huntington Creek.

Alternative C - Burnout Canyon Route (2) - Potential impacts for this route are the same for those common segments described in the preceding route description. The only difference is Segment 14 is replaced by Segments 15 and 17*. Segment 17* is part of the existing route and would have no further impact on recreation. However, Segment 15 crosses an area with a ROS class of SPM recreation and would somewhat diminish the recreation experience of dispersed users encountering the right-of-way.

Alternative C - Burnout Canyon Routes (3) and (4) - The impacts along these routes would be the same as Burnout Canyon Routes (1) and (2) respectively.

Alternative D - Gooseberry Route - Segments 19* and 23* are part of the existing route and would have no further impact to recreation. Segments 3a and 3b would reduce the recreation experience for users that encounter this segment in remote areas. Segment 2, 3a, and a small portion of Segment 3b would have moderate impacts to the experience sought by recreation users fishing along Upper Huntington Creek.

Segment 1 would adversely affect the undeveloped motorized recreation sites in the vicinity of Gooseberry Campground. Segment 1 would have some effects that could diminish the experience of dispersed recreation users around a private church camp in Little Swens Canyon.

Valley Camp Triangle Connector (1) - Segments 7* and 10* are part of the existing route and would have no impact on recreation. Segment 6 would have minor effects to users of the recreation access road paralleled by this segment. Segment 5 would affect the experience of dispersed recreation users in an area with a ROS class of SPM recreation.

Valley Camp Triangle Connector (2) - Segment 10*, part of the existing route, parallels a recreation access road. Segment 4 would have minor effects to users' experience on a recreation access road paralleled by this segment.

Valley Camp Triangle Connector (3) - Both segments 4 and 9 would have minor effects to users' experience on a recreation access road paralleled by this segment.

Alternative E - Winter Quarters Route (1) - Segment 12* is part of the existing route and would have no further impact on recreation. Segments 22 and most of 20 cross private lands that are not available for public recreation. The western 2.5 miles of Segment 20 crosses National Forest System lands and would cause minor impacts to recreational use. No new impacts would occur along associated Segments 19* and 23*.

Alternative E - Winter Quarters Route (2) - Segments 12* and 23* are part of the existing route and would have no impact on recreation. All of Segment 21 and most of Segment 20 cross private lands that are not available for public recreation. The portion of Segment 20 on National Forest System lands would have minor recreation impacts to an area with a ROS class of SPM recreation. No new impacts would occur along associated Segment 19*.

COMBINED RESOURCE EFFECTS

Short-Term Uses Versus Long-Term Productivity

Alternative A - No Action - The pipeline has been in place since 1953 and the disturbed corridor was revegetated with understory species of vegetation to decrease the potential for erosion. Trees (deep-rooted overstory) were not replanted in the corridor to avoid conflicts with maintenance of the pipeline. Productivity of the corridor with regard to timber production and habitat and cover for wildlife will not be restored until the existing pipeline is no longer needed and is abandoned. Until the overstory vegetation is restored to blend in with the surrounding vegetation, the corridor will remain a contrast to the visual characteristics of the surrounding views of Forest visitors. The recoverable coal beneath the existing pipeline can be mined to only a limited extent in order to protect the pipeline from the effects of subsidence.

Alternative B - Leave in Place, Full Extraction Mining - Construction of a redundant pipeline on the surface within the existing right-of-way would allow for both the operation of the existing pipeline and complete mining of the recoverable coal reserves beneath the pipeline. The loss of productivity of the area due to lack of overstory vegetation would be the same as discussed above under Alternative A. Surface disturbance from pipeline construction and repairs would remove some of the understory vegetation already established within the corridor. This would result in a long-term loss of rangeland and to additional short-term impacts as previously discussed in this document.

Alternative C - Burnout Canyon Routes (1) through (4) - The effects would be similar or the same for either of the two variations of this alternative route. Uses of the environment would involve rerouting the pipeline and fully mining the recoverable coal reserves beneath the existing corridor across the Skyline Mine permit area. In areas of unstable slopes the disruption of the surface could accelerate erosion and land movement, especially during abnormally wet years, potentially affecting vegetation. The existing pipeline would be abandoned and the corridor would be reclaimed (i.e., overstory vegetation would be replanted). Both understory and overstory vegetation would be removed from the new corridor for the construction of the new pipeline. The corridor would be revegetated with understory vegetation; however, trees could not be replanted where they would interfere with operation and maintenance of the pipeline. This would result in loss of wildlife habitat and cover and would create a contrast to the visual characteristics of the surrounding areas. Productivity of the abandoned corridor would be replaced by reestablishment of the overstory vegetation along the abandoned right-of-way and the productivity of the new right-of-way would be affected until reclamation is complete. Loss of overstory vegetation would continue until the corridor is abandoned and reclaimed (for the life of the pipeline). Sedimentation from the stream crossing in Upper Huntington Creek and the stream crossing in Burnout Canyon is unavoidable and could result in a temporary loss of productivity of the riparian vegetation and the spawning habitat in both creeks, which flow into Electric Lake.

Alternative D - Gooseberry Route - The effects associated with the construction of the pipeline would be similar to, or the same as, Alternative C with the exception that less riparian area and a smaller portion of the Upper Huntington Creek spawning habitat would be affected.

Valley Camp Triangle Connectors (1) through (3) - The effects associated with construction of the pipeline would be similar or the same for each of the four Connectors and as the alternatives described above with the exception that there are no riparian areas or streams crossed that would result in effects to the fisheries.

Alternative E - Winter Quarters Routes (1) and (2) - The effects associated with construction of the pipeline would be similar to the alternatives described above. Mud Creek is spawning tributary for Scofield Reservoir, which is one of Utah's top fishery reservoirs. The effects on the two variations of this alternative are similar with the exception that Winter Quarters Route (1) would affect less riparian vegetation and make fewer stream crossings consequently affecting fisheries less than Winter Quarters Route (2).

Irreversible and Irretrievable Commitment of Resources

Alternative A - No Action - Since no construction would take place, no surface resources would be affected or irreversibly and irretrievably committed. However, the recoverable coal left unmined to protect the pipeline against subsidence would be irretrievably committed considering current mining technology. Consequently, royalties from the coal would not be realized.

Alternative B - Leave in Place, Full Extraction Mining - The redundant pipeline would be constructed within the existing right-of-way unanchored to the surface and strain gauges for monitoring stress would be installed along the existing pipeline every 100 feet, which would require excavation. The presence of the surface pipeline would affect rangeland until such time that the pipeline is removed. Also the view of the pipeline would be a contrast to the visual characteristics of the surrounding views of Forest visitors. Other disturbance to the surface is expected to be minimal.

Alternative C - Burnout Canyon Routes (1) through (4) - The effects would be the same if not similar for each of the 4 variations of this alternative route. Recoverable coal left unmined to protect the pipeline from subsidence would be irreversibly committed considering current mining technology. Disturbance of unstable slopes could result in erosion and/or mass land movement consequently affecting vegetation. Stands of trees and other vegetation would be cleared from the right-of-way in some areas. Although the right-of-way would be revegetated with understory species, trees could not be planted for the life of the project in areas that would interfere with maintenance of the pipeline. Consequently, wildlife and fish habitat and cover would be affected. Also, contrast with the visual characteristics of the surrounding area would be long-term. Cultural and paleontological resources are nonrenewable resources and if unidentified cultural or paleontological resources are damaged or destroyed as a result of construction, these resources cannot be recovered. However, cultural resources stipulations attached to the COMP (Appendix A) would be appropriate measures to mitigate potential adverse impacts to cultural and paleontological resources.

Alternative D - Gooseberry Route - The irreversible and irretrievable commitment of resources associated with the construction of the pipeline would be the same as described for Alternative C.

Valley Camp Triangle Connectors (1) through (3) - The irreversible and irretrievable commitment of resources associated with construction of the pipeline along each of the 3 Connectors would be the same as described for Alternatives C and D above. It should be noted that no cultural resources were identified during the intensive survey of the Connectors; however, cultural resources may be discovered during construction and if damaged or destroyed these resources cannot be recovered. Appropriate steps to mitigate unforeseen adverse effects to cultural and paleontological resources are specified in Attachment A of Appendix A.

Alternative E - Winter Quarters Routes (1) and (2) - The irreversible and irretrievable commitment of resources associated with the construction of the pipeline would be the same as described for Alternatives C and D above.

Cumulative Effects

It is important to note that no matter which alternative is selected, the pipeline would probably impact or be impacted by recoverable coal reserves in the future.

Alternative A - No Action - Since no construction would take place, there would be no effects to surface resources. However, if no action is taken, then the estimated 14.9 mmt of recoverable coal worth approximately $372.5 million would not be mined and the 8 percent royalties of $29.8 million to the Federal and State governments would not be realized.

Alternative B - Leave in Place, Full Extraction Mining - The installation of a redundant pipeline on the surface would allow mining of the 14.9 mmt of recoverable coal and the $29.8 million of royalties would be realized. Construction of the redundant pipeline on the surface would result in comparatively few effects to the environment; short-term loss of vegetation, long-term loss of rangeland, long-term visual impacts, and potential conflicts with public uses on the Forest. However, the cost for construction of the specialized redundant pipeline, annual maintenance costs combined with the potentially extensive repairs would be very costly and the integrity and reliability of the system could not be guaranteed. In addition, the exposed line would be subject to natural accidents and intentional and unintentional vandalism. These repairs would result in potentially numerous short-term impacts to the environment (e.g., vegetation clearing, erosion potential conflicts with public uses of the Forest).

Alternative C - Burnout Canyon Routes (1) through (4) - The majority of the effects that could result from the construction of the pipeline along any variation of this alternative route would be short term. Overall cumulative effects to vegetation should be minimal and are strongly related to plant community recovery capabilities. There would be a period following construction of increased cumulative impact that is heightened by ongoing regional impacts related to grazing, timber harvest and other land uses. These effects eventually would be reversed through natural processes. Long-term effects would include removal of overstory (wildlife habitat and cover, and visual contrasts) and potential landsliding, both of which could add to the effects of previous impacts in the area (e.g., the existing corridor, Highway 264). Most notably, construction activities along the streams in Upper Huntington Canyon (an important spawning habitat of the Yellowstone cutthroat trout) and Burnout Canyon could cause long-term impacts with cumulative effects. Removal of vegetation proximal to a stream, disturbance to unstable slopes and stream banks adjacent to the streams, and trenching of the streambed (even using a culvert for diverting the water as a mitigation measure) could cause sedimentation that would affect the aquatic ecology of the streams. Spawning would not be affected in 1990 as construction would be allowed only after fry have left the stream. However, spawning habitat could be adversely affected for years into the future since some sediment would be generated that would not wash into Electric Lake for years to come. These impacts would add to the effects of previous impacts in the area (e.g., Highway 264). Impacts along Burnout Canyon Routes (3) and (4) would be less since there would be only a few crossings of Upper Huntington Creek, and the routes would be located on the west side of State Highway 264 not in the riparian area along Upper Huntington Creek.

Alternative D - Gooseberry Route - Cumulative effects along the Gooseberry Route are nearly the same as those along Alternative C except that less riparian vegetation and a smaller portion of the Upper Huntington Creek fishery would be affected.

Valley Camp Triangle Connectors (1) through (3) - Cumulative effects along each of the 3 Connectors would be similar to those described for Alternatives C and D. However, no streams or riparian vegetation would be crossed; therefore, there would be no effects to fisheries.

Alternative E - Winter Quarters Routes (1) and (2) - Cumulative effects along each of the two variations of this alternative route would be similar to those described for Alternative C above with the exception that the Winter Quarters Routes would not affect high-quality fisheries to the extent of Alternatives C (1) and (2) and D. It is anticipated that the potential effects to fisheries from sedimentation of the streams and Scofield Reservoir would be low to moderate.

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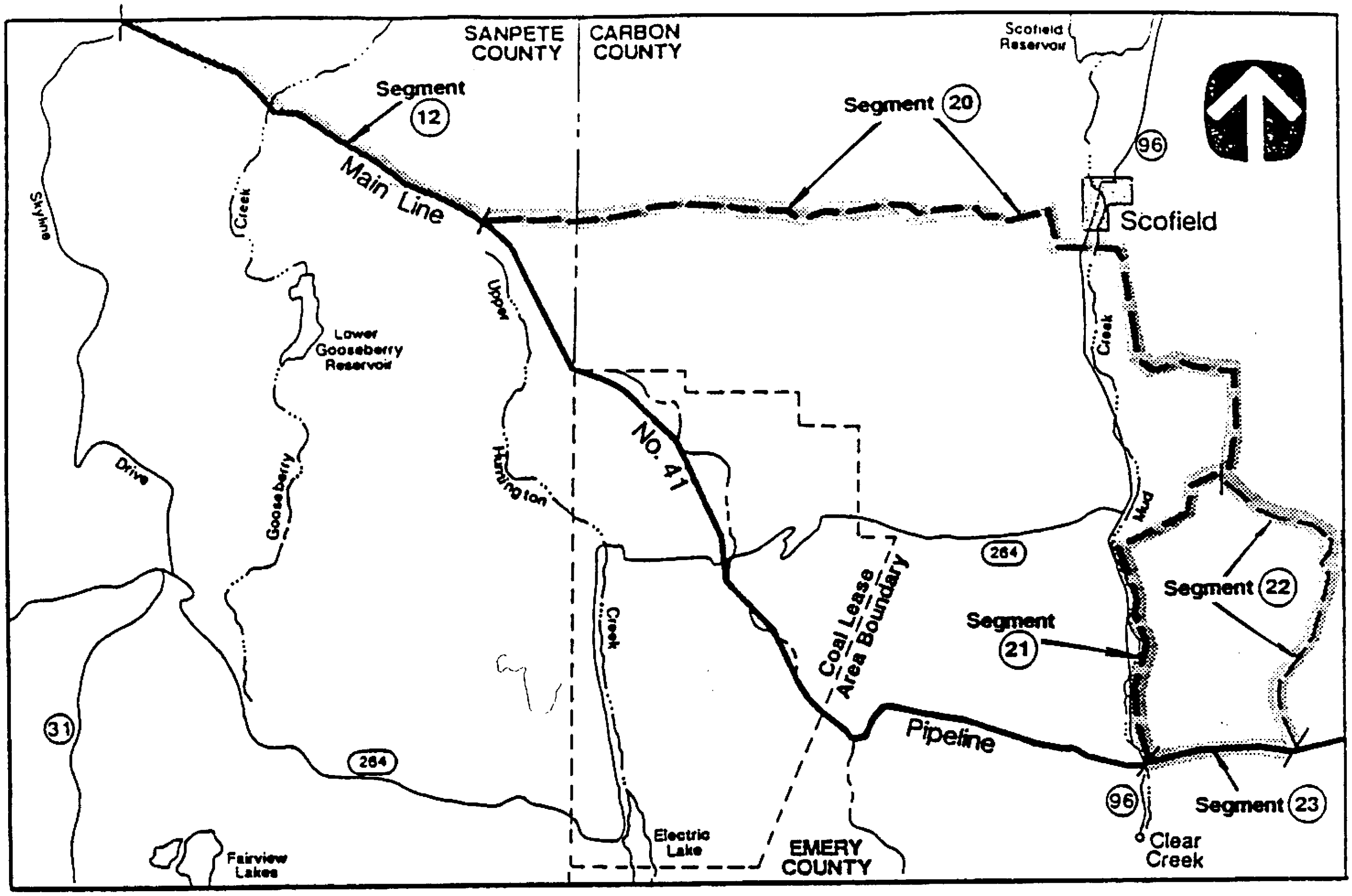

FIGURE B-4. THE WINTER QUARTERS ROUTE

Segments 12*, 20, 21, 23*; variation Segment 22; associated Segment 19*

Segment 12* (3.7 miles in length) is part of the existing pipeline and for purpose of this study begins in the northwest quarter of Section 25, T.12 S., R.5 E. (SLM) at the headward side of the Cabin Hollow Creek Drainage. The pipeline trends southeasterly from near the junction of Skyline Drive and an unimproved two-track road, the latter of which runs adjacent to the pipeline for one-half mile before turning south. One-third mile thereafter, the pipeline begins descending some 1,000 feet in elevation over the next mile to the crossing at Gooseberry Creek, then ascends nearly 1,400 feet over the remaining 2.2 miles.

An unimproved two-track road roughly parallels the pipeline for some 2.6 miles beginning about 0.4 mile west of the Gooseberry Creek crossing to the eastern end of Segment 12*. The roadway crosses the pipeline at numerous locations along the segment.

Segment 20 (9.1 miles in length) trends east/west for approximately two-thirds of its proposed length along the upland reaches of Winter Quarters Ridge before descending just west of Scofield to crossings situated at an unimproved two-track road, Winter Quarters Creek and Mud Creek. After skirting the southern corporate limits of Scofield, the segment turns southward just east of Mud Creek atop the ridgeline separating Pleasant Valley on the west and UP Canyon to the east for the distance of 1.1 miles. At

that point, the proposed segment turns east for .75 mile and then south for the remaining distance.

An unimproved two-track road would run adjacent to the proposed pipeline segment from the vicinity of Scofield to the junction with either Segment 21 or 22.

Segment 21 (3.1 miles in length) descends the ridgeline north of Broads Canyon crossing along its course 2 unimproved roads and the stream at the mouth of Broads Canyon before reaching and crossing Mud Creek. The proposed pipeline segment then runs upstream adjacent to and west of Mud Creek until the mouth of Slaughter House Canyon where the pipeline crosses to the east side of the creek near an existing highway culvert. The segment then continues upstream to connect with the existing pipeline just east of Utah State Highway 96.

Segment 23* (1.3 miles in length), part of the existing pipeline, differs in elevation by over 1,200 feet between the western end (lowest) and eastern end (highest) of the segment. The pipeline follows the ridgeline between Boneyard Canyon on the north and Magazine Canyon to the south and continues eastward to a topographic feature referred to as "The Elbow". This location marks the eastern extent of the proposed pipeline reroute project and is situated in the southwestern quarter of Section 27, T.13 S., R.7 E. (SLM).

Segment 22 (3.3 miles in length) is an eastern alternative for the Winter Quarters Route. The proposed segment instead of descending along the ridgeline of Broads Canyon like Segment 21, sidles eastward and southward along the upper reaches of Broads Canyon before rejoining the existing pipeline at "The Elbow". Unimproved two-track roads exist adjacent to the proposed pipeline alignment.

Segment 19* (2.8 miles of existing pipeline) is not a part of either Winter Quarters Routes (1) or (2). However, if either of these routes is selected, the existing pipeline of Segment 19* cannot be abandoned as it is needed to supply gas to a tap line that joins Main Line No. 41 at the western terminus of Segment 19*. Because this segment cannot be abandoned, the environmental resources are addressed along Segment 19* not as part of the routes, but as a segment associated with the route.

The first one-half mile on the western end of Segment 19* trends northeasterly before turning in a southeasterly direction. The southeastern component follows the ridgeline between Slaughter House Canyon on the north and Boardinghouse Canyon to the south and crosses and runs parallel to a unimproved road for nearly 0.5 mile at the western end of the component. At the eastern end of the segment, the topography descends nearly 1,100 feet over the last 0.5 mile, crossing State Highway 96 and Mud Creek near the junction with Segment 23*.

VEGETATION RESOURCES
GROUND COAL MINING PERMIT APPLICATION
UCO, INC.
1982

GROUND COAL MINING PERMIT APPLICATION

SCOFIELD MINE

CARBON COUNTY, UTAH

UCO, Inc.
7355 E. Orchard Rd.
Suite 100
Englewood, Colorado 80111

September, 1982

CHAPTER VIII

VEGETATION RESOURCES

VEGETATION RESOURCES

SCOFIELD MINE

CARBON COUNTY, UTAH

prepared for

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prepared by

Western Resource Development Corporation
711 Walnut Street, P. O. Box 467, Boulder, CO 80306

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SECTION 1.0

INTRODUCTION

1.0 SCOPE

1.1 OBJECTIVES

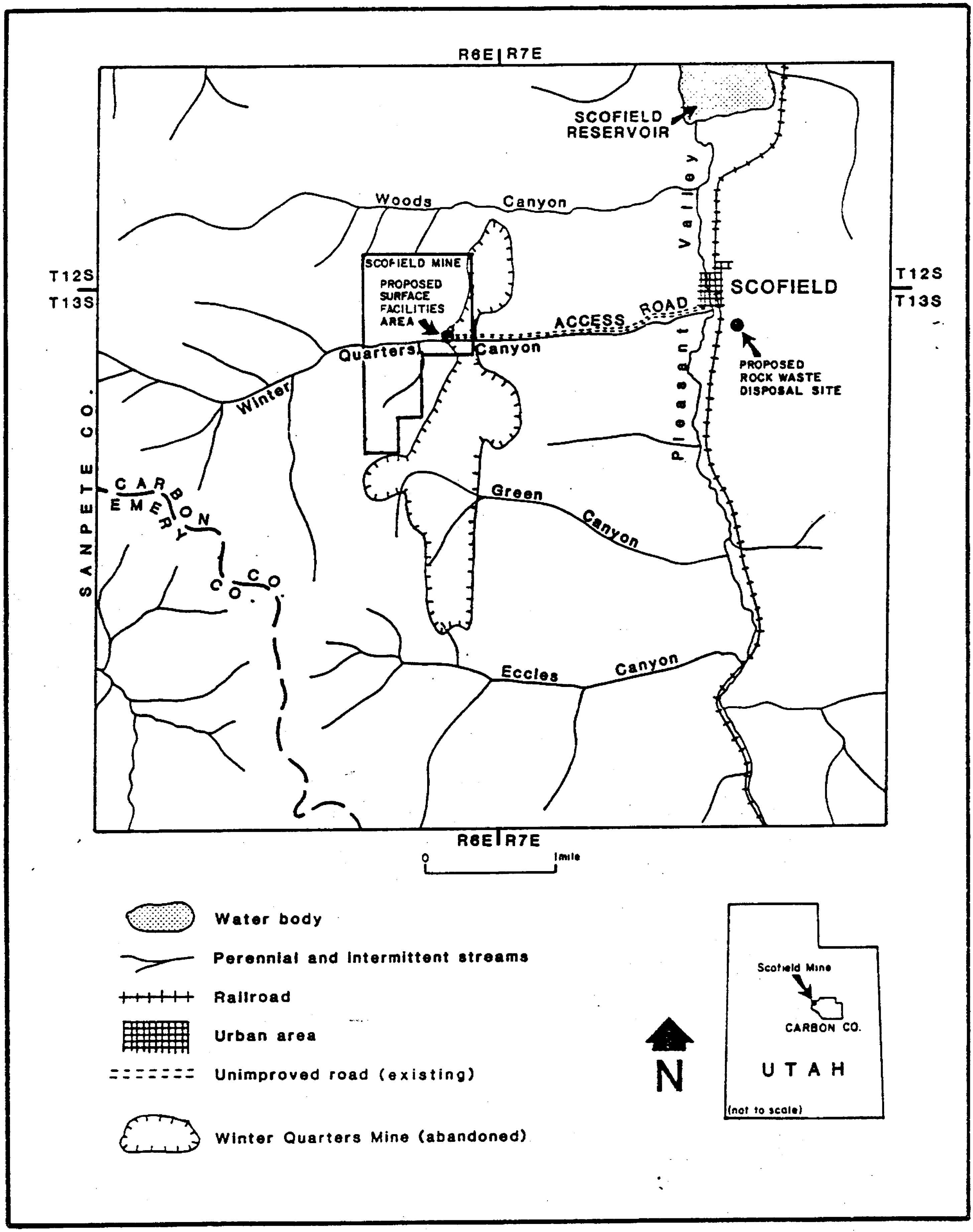
During the 1981 growing season a quantitative vegetation study was conducted for the proposed Scofield Mine in Carbon County, Utah. Figure 1 illustrates the location of the project with respect to the town of Scofield and the major topographic features. The study was conducted in accordance with final rules of the Utah Board and Division of Oil, Gas, and Mining (DOGM). Prior to the initiation of the field work a detailed study plan was presented to DOGM personnel (Ms. Mary Ann Wright) for review in December 1980. All aspects of the study met with Ms. Wright's approval. Furthermore, during the course of the study DOGM was informed of the progress of the study and consulted regarding various changes in the project.

Field studies commenced in late April when grazing exclosures were constructed and the floral inventory was begun. Monthly visits were made until September to collect plants. During August and early September, cover, stem density, and production data were collected.

1.2 LOCATION AND ECOLOGICAL SETTING

The study area is located in Winter Quarters Canyon along the east side of the Wasatch Plateau adjacent to Pleasant Valley in Carbon County near the small town of Scofield, Utah (Figure 1). Winter Quarters Canyon was the site of the first commercial coal mine in Utah, beginning production (Utah Archaeological Research Corporation 1981) in 1876. Between that time and the closing of the Winter Quarters Mine in 1928, some 10.8 million tons of coal were removed. A town known as Winter Quarters existed around the mine portals and facilities for a distance of about 2 mi (3.2 km) west from the town of Scofield. Because of the narrowness of the valley, the valley bottom for that distance was virtually totally covered by the mine portals, surface facilities, railroad spur, and residential facilities. Consequently, much of the present ecology of lower Winter Quarters Canyon has been shaped by the historic mining disturbances. Photographs from around 1900 (Utah Archaeological Research Corporation 1981) show no trace of natural riparian vegetation left and, indeed, the stream channel is not visible in many of the photographs because it was piped under the surface to make room for the facilities.

The demand for mine timbers resulted in the early deforestation of the spruce-fir forest on the north-facing slopes in the valley. Photographics from about 1900 (Utah Archaeological Research Corporation 1981) show a low growth of aspen and a few scattered tall thin conifers left uncut for one reason or another. By 1916, photographs show aspen height had increased and conifer regrowth under the aspen is conspicuous. On the south-facing slopes of the valley, conditions in the old photographs seem very similar to current conditions with sagebrush and mountain brush predominating.



SCOFIELD MINE PROJECT AREA

FIGURE 1

SECTION 2.0

METHODS

2.0 METHODS

2.1 VEGETATION MAPPING

Vegetation type mapping was undertaken for the Scofield Mine project area and a surrounding 500 foot buffer zone. Mapping was accomplished using U.S. Forest Service aerial photography (black and white, approximately 1:16,000 scale) (1 inch = 1400 feet) and field checking. Vegetation types are segregated on the basis of physiognomy and dominant species.

2.2 SPECIES LIST

In order to ensure as complete a species list as possible, plant specimens were collected on the site on a monthly basis between April and September. Field identifications were checked by Dr. William A. Weber, Curator of the Herbarium, University of Colorado, Boulder. Voucher specimens from the study are preserved in a permanent reference collection by Western Resource Development Corporation for UCO.

Taxonomic nomenclature used in this report follows Weber and Johnston (1979) as the primary reference except as noted under Section 3.4, Floral Composition. Common names used come from Nickerson et al. (1976), U.S. Soil Conservation Service (1978), and Beetle (1970), in decreasing order of priority. Comments on native or introduced status are based on Weber and Johnston (1979).

2.3 AFFECTED AREA SAMPLING DESIGN

Most of the proposed Scofield Mine affected area was disturbed by historic mining activities and is presently grazed each year by domestic livestock.

Quantitative sampling was confined to the approximate area to be disturbed (Plates 1 and 2). The sampling area extended upslope somewhat farther on the south-facing slopes than disturbance is likely to extend. This allowed inclusion of more areas of Mountain Shrubland in natural premining condition and resulted in baseline data representing a more undisturbed condition than exists at the very bottom of the slope in the abandoned Winter Quarters Mine facilities areas. All sample sites were selected by a random process in which a grid of 15 m x 15 m cells was overlain on a 1" = 100' map of the disturbed area and a random number table used to assign spatial (x,y) coordinates. Fifty sample points were selected in each affected area vegetation type. The points in each vegetation type were numbered in order of their random selection.

Sample sites in the riparian and mountain shrub affected and reference areas were located in the field between April 20 and May 1, 1981, using 1" = 100' maps. At each site, a range cage was erected to protect the enclosed area from domestic sheep, which heavily graze the area, as well as cattle, deer, elk, and occasional moose. Each cage was constructed of

48 inch "no-climb" welded wire fencing material, cut and formed into a conical configuration and firmly anchored with four 5-foot lengths of 3/8-inch steel rebar. Each range cage enclosed an area of about 1.2 m^2 in order to protect 1.0 m^2 for later clipping. Each range cage was marked with a metal tag bearing its identification number. Data on plant cover and woody plant density were obtained along transects oriented randomly from the range cages. These methods are described more fully under Cover, Woody Plant Density, and Production sections below.

During the course of the study the mine plan was altered to include a small area of disturbance in the spruce-fir forest on the north-facing slope. By this time sheep had access to this area and did graze the forest to some extent. However, the herbaceous production of this closed canopy forest is extremely low. DOGM personnel determined in a verbal decision that production data were unnecessary for the Spruce-fir Forest because of the extremely low herbaceous cover and the limited biomass production.

2.4 SELECTION OF REFERENCE AREAS OR OTHER RECLAMATION STANDARDS

For establishment of reclamation standards, reference areas were selected for the riparian and mountain shrubland vegetation types because they are the major areas of disturbance. The disturbance to the spruce-fir forest will be much smaller and the vegetation of the type is largely long-lived woody species in which little year-to-year change in vegetation parameters is expected. Because of this, the baseline method for establishing a reclamation standard was chosen. Thus, for the riparian meadow and shrubland and mountain shrubland, the standard against which the post-reclamation vegetation is compared is the reference area, although since baseline data exist for the affected area also, these baseline data could also be used. For the spruce-fir forest area, the standard for determination of reclamation success will be the baseline data from the affected area.

In the case of the riparian vegetation type, the chances of finding a reference area exactly the same as the affected area were small because, in the affected area this type has developed on the disturbed material left from the abandoned town and historic mining activities of the Winter Quarters Mines which, as mentioned earlier, occupied the entire valley bottom. The vegetation that has redeveloped along the stream has done so on the eroded fill left from the old town and mine facilities. This fill is comprised of varying parts soil, coal fines, and junk. Although the native riparian species have made substantial reappearance, the composition is still not equal to that of the essentially undisturbed community found upstream of the previously affected area. This area upstream represented the only apparent alternative as a reference area (Plates 1 and 2). The mountain shrubland reference area is also located up valley to the west, just east of the Manti-LaSal National Forest boundary (Plates 1 and 2). This reference area, although located on the same slope, exposure, and parent material as the affected area, includes entirely the area outside the abandoned Winter Quarters Mines disturbed area whereas the proposed affected area includes much area previously disturbed and revegetated by natural secondary succession. Also, it is located somewhat further upslope from the valley bottom and may avoid the heavy sheep grazing incurred on the affected area as sheep are slowly moved up the valley to higher pastures within the Manti-LaSal National Forest in the spring. The net effect is that range condition of the reference area seems better than that of the affected area as a whole.

2.5 REFERENCE AREA SAMPLING DESIGN

In each reference area, sample sites were located by the same random process used in the affected area, except that the cells measured 5 m x 5 m. A total of thirty sample sites wre selected in each reference area and range cages were erected on them between 20 April and 1 May 1981.

2.6 TIME OF SAMPLING

Cover, woody plant density, and production sampling were completed between 13 August and 8 September 1981.

2.7 COVER SAMPLING

Cover was measured at fifty points along 50 m transects using the point-intercept method (Mueller-Dombois and Ellenberg 1974). Transects, which were randomly oriented from the corresponding range cages, were sampled sequentially in order of selection during the random location process. Measurements began one meter out from the range cage to avoid trampling effects.

At each point, a plant ecologist viewed the ground through a vertically oriented sighting device affixed to an adjustable tripod. Fine cross hairs within the device were used to provide precise point definition.

The first hit (interception) along a vertical viewing line was recorded as being vegetation (by species), rock, litter, or soil. Vegetation intercepted below first hits was recorded separately by species; the maximum number of hits recorded at any point was four. Only first hits were used in calculating cover, which is therefore absolute cover.

Species that were present in the sample stands but not actually hit during the point-intercept sampling are indicated by a "P" in the cover data tables. Frequency values were calculated on the basis of whether a species was present in the sampled stands, not on whether it was encountered during quantitative sampling.

2.8 PRODUCTION SAMPLING

Production data were obtained by removing the range cages and clipping current year's growth above-ground biomass within a 1 m^2 circular hoop placed within the protected area. All graminoids, including perennials and annuals, were separated by species while bagging samples in the field. Perennial and annual forbs were lumped into a single sample category. Cacti, cushion plants, noxious weeds, cryptogams, shrubs, and subshrubs were not sampled for production.

Production samples were returned to the lab, where they were oven dried at 105°C for 24 hours and weighed to the nearest 0.1 g. Data are reported in the production data tables as g/m^2, pounds/acre, and kg/ha. The conversion factors used were 8.91 (from g/m^2 to pounds/acre) and 10.0 (from g/m^2 to kg/ha).

2.9 SHRUB MEASUREMENTS

Shrubs and tree seedlings or saplings (below breast height, 4.25 feet or 1.3 m) rooted within 1 m by 50 m rectangular quadrats (also known as belt transects or line strips) located along the 50 m cover transect at each site were counted by species, and the heights of the first two shrubs of each species encountered were recorded in classes as follows: 1 cm below 10 cm, 5 cm increments between 10 cm and 50 cm, and 10 cm increments above 50 cm. In the Spruce-fir Forest type, shrubs were counted in a 1 m x 25 m quadrat.

2.10 TREE MEASUREMENTS

For the spruce-fir forest vegetation type, trees were sampled along the first 25 m of each cover transect in a 5 m wide quadrat. Within this quadrat, all trees above breast height (4.25 ft or 1.3 m) were counted by species and whether they were alive or dead. The diameter at breast height (dbh) was measured for each tree also. Using these data, density (number of trees per acre and hectare) and basal area (square feet per acre and square meters per hectare) were calculated. Several trees were aged using an increment borer.

2.11 SAMPLE ADEQUACY CALCULATION

Adequacy of samples was calculated using the formula

$$n_{min} = \frac{s^2 t^2}{d^2 \bar{x}^2}$$

where n_{min} = the minimum number of samples required

s = standard deviation (n-1)

t = two-tailed t value, with infinite degrees of freedom, for a prescribed level of confidence

d = the desired detectable reduction in the mean (0.1)

$\bar{x}$ = arithmetic mean

For shrublands, 80% confidence levels were used; for non-shrublands, 90% confidence levels were used (Utah Division of Oil, Gas, and Mining 1981).

Total woody plant density (live trees plus shrubs) were the data used for density sample adequacy calculations.

SECTION 3.0

EXISTING RESOURCES

3.0 EXISTING RESOURCES

3.1 GENERAL SITE DESCRIPTION

Elevations in the project area vary from about 7,700 feet (2,348 m) to about 9,200 feet (2,805 m). Average annual precipitation in the study area is estimated by Beak Consultants (1981) to be about 28 inches (71 cm), mostly falling as snow during fall and winter. Soil parent material on the slopes consists of a veneer of colluvium overlying bedrock. In the valley bottom, substrates are alluvium, colluvium, and fill from historic mining activities. Undisturbed soils in the project area have surface horizons relatively thick and dark and exchange sites dominated by bivalent cations (Walsh and Associates 1981, Soil Survey Staff 1975). Soils of the steep valley sides have formed in colluvium and are very rocky. Soils in the toe slopes and valley bottoms have formed in transported material and are deeper and less rocky.

3.2 VEGETATION DESCRIPTION

Vegetation of the study area is of four main types: Mountain Shrubland, Spruce-fir Forest, Aspen Forest, and Riparian Shrubland (Plate 1). Mountain Shrubland occurs primarily on the south-facing side of the valley. Spruce-fir Forest occurs on the north-facing side of the valley and in the bottoms of side drainages. Aspen Forest occurs in the moister locations on the south-facing side of the valley and in the drier and/or most recently disturbed sites on the north-facing side of the valley. Because Aspen Forest is successional to Spruce-fir Forest, there is a continuum of variation between the two types. Riparian Shrubland occurs on the miscellaneous transported materials in the valley bottom.

Quantitative data were collected in the affected area vegetation types at locations indicated in Plate 2.

3.2.1 Cover Data

Presented in Tables A-1 through A-5 are cover data from the quantitative samples in the affected and reference areas for the Mountain Shrubland and Riparian Shrubland vegetation types and the affected area of the Spruce-fir Forest vegetation type. Data are in the form of absolute percent cover; that is, vegetation plus rock plus litter plus soil sums to 100 percent. Cover data are summarized in Table 1.

3.2.2 Production Data

Presented in Tables A-6 through A-9 are production data from the Mountain Shrubland and Riparian Shrubland affected and reference areas. Data are oven-dry grams per square meter. Production data are summarized in Table 2.

TABLE 1

SUMMARY OF COVER DATA
SCOFIELD MINE VEGETATION STUDY

Vegetation Type	Total Absolute Vegetative Cover % mean	SD[a]	Soil % mean	Litter % mean	Rock % mean	Total Vegetation + Litter + Rock % mean	SD[a]
Mountain Shrubland							
Affected	55.6	10.7	19.4	13.2	11.8	80.6	8.2
Control	72.7	5.8	9.9	13.3	4.1	90.1	4.2
Riparian							
Affected	82.7	10.1	9.2	6.1	2.0	90.8	8.9
Control	88.3	6.2	5.7	4.4	1.6	94.3	4.5
Spruce-fir Woodland	73.5	9.6	0.3	25.3	0.9	99.7	0.7

[a]Standard Deviation (n-1)

TABLE 2

SUMMARY OF PRODUCTION DATA
SCOFIELD MINE VEGETATION STUDY

Vegetation Type	mean g/m^2	SD[a]	mean/ha	mean/A
Mountain Shrubland				
Affected	62.2	47.8	622.2	554.3
Reference	65.9	38.3	658.9	587.1
Riparian Meadow and Shrubland				
Affected	212.9	102.9	2129.1	1897.0
Reference	208.8	128.6	2088.4	1860.8
Spruce Fir Woodland				
Affected	-	-	-	-

[a]Standard Deviation (n-1)

3.2.3 Shrub and Tree Data

Presented in Tables A-10 through A-13 are the shrub density data from the Mountain Shrubland and Riparian Shrubland vegetation types affected and reference areas. Table A-14 presents data from the Riparian Meadow and Shrubland affected and reference areas. Tables A-15, A-16, and A-17, respectively, present shrub density, tree density, and tree basal area for the Spruce-fir Forest affected area. Woody plant density data are summarized in Table 3.

3.2.4 Description of Vegetation Types

Mountain Shrubland (Figure 2)

Vegetational cover of the Mountain Shrubland vegetation type (Table A-1) is dominated by shrubs and subshrubs which account for 42.8 percent cover (77.0 percent of vegetational cover). The main contributors to this cover are *Artemisia tridentata* ssp. *vaseyana* (Vasey big sagebrush) with 19.9 percent cover, *Symphoricarpos oreophilus* (mountain snowberry) with 8.3 percent cover, *Purshia tridentata* (antelope bitterbrush) with 3.2 percent cover, and *Amelanchier alnifolia* (saskatoon serviceberry) with 3.0 percent cover. Other shrubs or subshrubs present in lesser amounts include *Artemisia cana* (silver sagebrush), *Artemisia frigida* (fringed sage), *Chrysothamnus nauseosus* (rubber rabbitbrush), *Chrysothamnus viscidiflorus* (Douglas rabbitbrush), *Mahonia repens* (Oregon grape), *Pachistima myrsinites* (myrtle pachistima), *Prunus virginiana* var. *melanocarpa* (common chokecherry), *Quercus gambelii* (Gambel's oak), *Ribes cereum* (wax currant), *Ribes viscosissimum* (sticky currant), *Rosa woodsii* (Woods' rose), *Sambucus coerulea* (blueberry elder), *Shepherdia canadensis* (Canada buffaloberry), and *Xanthocephalum sarothrae* (broom snakeweed). Very occasionally, scattered within the Mountain Shrubland vegetation type are trees including *Juniperus scopulorum* (Rocky Mountain juniper) and *Populus tremuloides* (quaking aspen).

After shrubs and subshrubs, perennial graminoids are the next most abundant lifeform with 9.2 percent cover. Major species include *Agropyron spicatum* (bluebunch wheatgrass) with 3.7 percent cover, *Stipa lettermanii* (Letterman needlegrass) with 2.2 percent cover, and *Poa pratensis* (Kentucky bluegrass) with 1.7 percent cover. Other species present include *Agropyron albicans* (Montana wheatgrass), *Agropyron dasystachyum* var. *riparium* (streambank wheatgrass), *Agropyron smithii* (western wheatgrass), *Agropyron subsecundum* (bearded wheatgrass), *Agropyron trachycaulum* (slender wheatgrass), *Bromopsis inermis* ssp. *pumpellianus* (Pumpelly brome), *Carex geyeri* (elk sedge), *Elymus cinereus* (basin wildrye), *Juncus arcticus* ssp. *balticus* (Baltic rush), *Koeleria macrantha* (prairie junegrass), *Muhlenbergia richardsonis* (mat muhly), *Oryzopsis hymenoides* (Indian ricegrass), and *Poa fendleriana* (mutton bluegrass).

Cover by perennial forbs totals only 3.5 percent. The major contributors to this cover are *Artemisia ludoviciana* (prairie sage), *Aster chilensis* (Pacific aster), *Penstemon* spp. (beard tongues including *P. whippleanus* and others), and *Smilacina stellata* (starry solomonplume). Other less abundant species include *Antennaria rosea* (rose pussytoes),

TABLE 3

SUMMARY OF SHRUB AND TREE DATA
SCOFIELD MINE VEGETATION STUDY

Vegetation Type	mean height (cm)	% Shrub Composition	Mean Density no./50 m^2	Mean Density no./ha	Mean Density no./ac
MOUNTAIN SHRUBLAND AFFECTED AREA					
Amelanchier alnifolia	109.3	2.5	2.1	416.3	168.5
Artemisia cana	57.2	1.5	1.3	257.1	104.1
Artemisia tridentata	62.3	22.2	18.5	3693.9	1494.9
Chrysothamnus nauseosus	62.3	8.1	6.8	1351.0	546.8
Chrysothamnus viscidiflorus	30.0	8.6	7.2	1432.7	579.8
Mahonia repens	9.5	11.0	9.2	1832.7	741.7
Populus tremuloides	92.5	<0.1	<0.1	8.2	3.3
Prunus virginiana	24.2	10.2	8.5	1693.8	685.5
Purshia tridentata	39.6	2.6	2.1	424.5	171.8
Ribes cereum	83.7	0.2	0.2	36.7	14.9
Rosa woodsii	32.0	7.8	6.5	1302.0	526.9
Rubus idaeus	12.5	0.2	0.2	36.7	14.9
Sambucus coerulea	131.0	<0.1	<0.1	12.2	5.0
Shepherdia canadensis	60.0	<0.1	<0.1	4.1	1.7
Symphoricarpos oreophilus	43.7	24.7	20.6	4110.2	1663.4
Tetradymia canescens	39.3	<0.1	<0.1	12.2	5.0
Total	-	100.0	83.1	16,624.5	6,727.8
MOUNTAIN SHRUBLAND REFERENCE AREA					
Amelanchier alnifolia	60.8	12.3	14.7	2940.0	1189.8
Artemisia tridentata	78.6	30.6	36.4	7286.6	2948.9
Chrysothamnus viscidiflorus	40.8	3.6	4.3	853.3	345.3
Mahonia repens	11.4	3.2	3.9	773.3	312.9
Pachistima myrsinites	15.1	0.2	0.3	53.3	21.6
Prunus virginiana	44.6	1.2	1.4	286.7	116.0
Purshia tridentata	43.3	4.3	5.1	1020.0	412.8
Rosa woodsii	27.2	7.5	8.9	1780.0	720.4
Symphoricarpos oreophilus	54.4	37.1	44.1	8826.7	3572.1
Total	-	100.0	119.1	23,820.0	9,639.8

TABLE 3 (cont.)

Vegetation Type	mean height (cm)	% Shrub Composition	Mean Density no./50 m^2	Mean Density no./ha	Mean Density no./ac
RIPARIAN MEADOW AND SHRUBLAND AFFECTED AREA					
Abies lasiocarpa (below 1.3 m)	48.0	3.6	1.0	196.0	79.3
Artemisia cana	42.5	3.6	1.0	196.0	79.3
Artemisia tridentata	36.0	0.7	0.2	40.0	16.2
Chrysothamnus nauseosus	65.8	2.0	0.5	108.0	43.7
Chrysothamnus viscidiflorus	42.7	0.9	0.2	48.0	19.4
Lonicera involucrata	76.1	8.8	2.4	480.0	194.3
Populus tremuloides (below 1.3 m)	80.0	1.4	0.4	76.0	30.8
Prunus virginiana	20.0	1.3	0.4	72.0	29.1
Ribes cereum	97.3	0.2	<0.1	12.0	4.9
Ribes inerme	33.2	0.5	0.1	28.0	11.3
Rosa woodsii	47.6	9.6	2.6	524.0	212.1
Rubus idaeus	28.8	2.6	0.7	144.0	58.3
Salix cf. caudata	177.9	33.1	9.1	1812.0	733.3
Salix exigua	88.0	8.9	2.4	488.0	197.5
Salix lasiandra	182.0	6.3	1.7	348.0	140.8
Salix subcoerulea	190.3	6.9	1.9	380.0	153.8
Shepherdia canadensis	73.3	1.9	0.5	104.0	42.1
Symphoricarpos oreophilus	75.2	7.7	2.1	424.0	171.6
Total	-	100.0	27.4	5,480.0	2,217.7
RIPARIAN MEADOW AND SHRUBLAND REFERENCE AREA					
Abies lasiocarpa (below 1.3 m)	41.0	0.9	0.2	40.0	16.2
Amelanchier alnifolia	50.0	0.3	<0.1	13.3	5.4
Chrysothamnus viscidiflorus	44.8	0.6	0.1	26.7	10.8
Lonicera involucrata	58.9	4.2	0.9	180.0	72.8
Picea engelmannii (below 1.3 m)	54.3	2.0	0.4	86.7	35.1
Ribes cereum	59.1	9.9	2.1	426.7	172.7
Ribes viscosissimum	56.0	1.7	0.4	73.3	29.7
Rubus idaeus	44.4	15.2	3.3	653.0	264.4
Salix cf. caudata	108.9	35.3	7.6	1520.0	615.1
Salix exigua	103.0	0.2	<0.1	6.6	2.7
Salix lasiandra	171.2	0.6	0.1	26.7	10.8
Salix subcoerulea	128.8	20.0	4.3	860.0	348.0
Shepherdia canadensis	60.7	1.7	0.4	73.3	29.7
Symphoricarpos oreophilus	76.5	7.4	1.6	320.0	129.5
Total	-	100.0	21.5	4,306.7	1,742.9

TABLE 3 (cont.)

Vegetation Type	mean height (cm)	% Shrub Composition	Mean Density no./50 m^2	no./ha	no./ac
SPRUCE-FIR FOREST AFFECTED AREA					
SHRUBS AND TREE REPRODUCTION					
Abies lasiocarpa (below 1.3 m)	28.6	8.7	4.8	960.0	388.5
Amelanchier alnifolia	36.1	1.4	0.8	160.0	64.8
Mahonia repens	9.0	7.2	4.0	800.0	323.8
Pachistima myrsinites	8.8	26.1	14.4	2880.0	1165.5
Physocarpus malvaceus	22.9	15.2	8.4	1680.0	679.9
Populus tremuloides (below 1.3 m)	32.7	5.8	3.2	640.0	259.0
Rosa woodsii	17.6	13.0	7.2	1440.0	582.8
Rubus idaeus	10.0	0.2	0.1	26.7	10.8
Rubus parviflorus	21.0	0.5	0.3	53.3	21.6
Sambucus coerulea	35.0	0.2	0.1	26.7	10.8
Shepherdia canadensis	32.5	0.5	0.3	53.3	21.6
Sorbus scopulina	35.0	0.2	0.1	26.7	10.8
Symphoricarpos oreophilus	30.7	8.3	4.6	920.0	372.3
TREES (LIVE)					
Abies lasiocarpa	~24 m	7.4	4.1	816.0	330.2
Picea engelmannii	~24 m	0.3	0.2	37.3	15.1
Populus tremuloides	~24 m	5.0	2.8	560.0	226.2
Total	-	100.0	55.4	11,080.0	4,483.7

Anticlea elegans (mountain death camas), *Astragalus* sp. (milkvetch), *Castilleja linariaefolia* (Wyoming paintbrush), *Cirsium undulatum* (wavyleaf thistle), *Dugaldia hoopesii* (orange sneezeweed), *Eriogonum racemosum* (redroot wildbuckwheat), *Eriogonum subalpinum* (subalpine wildbuckwheat), *Geranium richardsonii* (Richardson geranium), *Ipomopsis aggregata* (scarlet gilia), *Iva axillaris* (poverty sumpweed), *Lupinus caudatus* (tailcup lupine), *Machaeranthera canescens* (silver machaeranthera), *Orobanche* sp. (broomrape), *Orthocarpus luteus* (yellow owl clover), *Senecio integerrimus* (lambstongue groundsel), *Senecio multilobatus* (lobeleaf groundsel), and *Urtica dioica* (bigsting nettle).

Total vegetation cover in the Mountain Shrubland affected area is 55.6 percent. Bare soil, litter, and rock cover values are 19.4, 13.2, and 11.8 percent, respectively.

Production (Table A-6) in the Mountain Shrubland affected area is 554 lbs per acre, oven dry. Graminoid production totals 336 lbs per acre. Major contributors are *Stipa lettermanii* (191 lbs/acre) and *Agropyron spicatum* (77 lbs/acre). Making a moderate contribution are *Poa pratensis* (16 lbs/acre), *Agropyron dasystachyum* var. *riparium* (12 lbs/acre), and *Carex geyeri* (12 lbs/acre). Forb production totals 219 lbs/acre.

Total shrub density (Table A-10) in the affected area of Mountain Shrubland is 6,728 stems/acre. The major contributors to stem density are *Symphoricarpos oreophilus* (1,663 stems/acre), *Artemisia tridentata* ssp. *vaseyana* (1,495 stems/acre), *Mahonia repens* (742 stems/acre), *Prunus virginiana* var. *melanocarpa* (686 stems/acre), *Chrysothamnus viscidiflorus* 580 stems/acre), *Chrysothamnus nauseosus* (547 stems/acre), and *Rosa woodsii* (527 stems/acre).

Riparian Meadow and Shrubland (Figure 3)

Cover in the Riparian Meadow and Shrubland vegetation types (Table A-2) is dominated by perennial graminoids which total 42.9 percent cover. Nearly half of this cover (16.6 percent) is comprised of *Juncus arcticus* ssp. *balticus*. Other major species include *Poa pratensis* (6.6 percent cover), *Carex praegracilis* (fieldclustered sedge) with 5.4 percent cover, *Stipa lettermanii* (5.0 percent cover), *Agrostis gigantea* (redtop) with 2.4 percent cover, and *Carex nebrascensis* (Nebraska sedge) with 2.0 percent cover. Other species present include *Agropyron subsecundum*, *Agropyron trachycaulum*, *Bromopsis ciliata* (fringed brome), *Calamagrostis canadensis* (northern reedgrass), *Carex aquatilis* (water sedge), *Carex geyeri*, *Carex microptera* (smallwing sedge), *Carex nigricans* (black alpine sedge), *Carex utriculata* (beaked sedge), *Deschampsia caespitosa* (tufted hairgrass), *Festuca pratensis* (meadow fescue), *Hordeum brachyantherum* (meadow barley), *Juncus tracyi* (Tracy rush), *Muhlenbergia richardsonis*, *Oryzopsis hymenoides*, *Phleum pratense* (timothy), *Poa palustris* (fowl bluegrass), *Stipa comata* (needle-and-thread), *Stipa occidentalis* (western needlegrass), and *Stipa viridula* (green needlegrass).

Next to perennial graminoids, shrubs and subshrubs are the next most abundant lifeform with 33.1 percent cover (40.0 percent of vegetational cover). Most of this amount (27.1 percent) is comprised of willows. These willows include *Salix* cf. *caudata* (unnamed willow) with 14.1 percent cover, *Salix lasiandra* (Pacific willow) with 6.7 percent cover, *Salix subcoerulea* (blue willow) with 5.5 percent cover, and *Salix exigua* (coyote willow) with 0.8 percent. Other shrubs present include *Artemisia cana* (silver sagebrush), *Artemisia tridentata* ssp. *vaseyana*, *Chrysothamnus nauseosus*, *Chrysothamnus viscidiflorus*, *Lonicera involucrata* (twinberry), *Prunus virginiana* var. *melanocarpa*, *Ribes cereum*, *Ribes inerme* (whitestem gooseberry), *Rosa woodsii*, *Shepherdia canadensis*, *Swida sericea* (red-osier dogwood), and *Symphoricarpos oreophilus*. Trees are present in the Riparian Meadow and Shrubland although their contribution to cover is very small. Species present include *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce), *Picea pungens* (blue spruce), and *Populus tremuloides* (quaking aspen).

Perennial forb cover totals only 5.0 percent. Major species are *Mentha arvensis* (field mint) with 1.3 percent cover, *Urtica dioica* with 1.0 percent cover, and *Cirsium undulatum* with 0.7 percent cover. Other species present include *Achillea millefolium* (western yarrow), *Aster chilensis*, *Cirsium coloradense* (elk thistle), *Cirsium flodmanii* (Flodman thistle), *Dugaldia hoopesii* (Orange sneezeweed), *Geum macrophyllum* (large-leaf avens), *Geranium richardsonii* (Richardson geranium), *Hackelia floribunda* (false forget-me-not), *Halerpestes cymbalaria* (shore buttercup), *Iva axillaris* (poverty sumpweed), *Machaeranthera canescens*, *Mimulus guttatus* (common monkeyflower), *Penstemon* spp., *Rudbeckia occidentalis* var. *montana* (western coneflower), *Rumex salicifolius* (willow dock), *Saxifraga odontoloma* (brook saxifrage), *Smilacina stellata* (starry solomonplume), and *Viola purpurea* (goosefoot violet).

Annual forbs comprise a small cover (0.8 percent) and include *Cynoglossum officinale* (houndstongue), *Epilobium paniculatum* (panicled willowherb), and *Eriogonum cernuum* (nodding wild buckwheat).

Cryptogams totaled 0.9 percent cover and included *Equisetum arvense* (field horsetail) and mosses.

Total vegetational cover in the Riparian Meadow and Shrubland vegetation type is 82.7 percent. Bare soil, litter, and rock cover values are 9.2, 6.1, and 2.0 percent, respectively.

Production (Table A-7) totaled 1,897 lbs/acre oven-dry. Graminoid production totaled 1,572 lbs/acre of which the major contributions were made by *Juncus arcticus* (753 lbs/acre), *Poa pratensis* (233 lbs/acre), *Stipa lettermanii* (151 lbs/acre), and *Agrostis gigantea* (116 lbs/acre). Forb production totaled 325 lbs/acre.

Shrub density (Table A-11) totals 2,218 stems/acre. Major contributors to this total include *Salix* cf. *caudata* (733 stems/acre), *Rosa woodsii* (212 stems/acre), *Salix exigua* (198 stems/acre), *Lonicera involucrata* (194 stems/acre), *Symphoricarpos oreophilus* (172 stems/acre), *Salix subcoerulea* (154 stems/acre), and *Salix lasiandra* (141 stems/acre).

In Table A-14 are presented results of an inventory of all trees above breast height (4.25 feet or 1.3 m) occurring in the Riparian Meadow and Shrubland affected area. The bulk of the trees present are very small aspen less than 2 inches (5 cm) dbh. Larger aspen are continually removed by beaver predation.

Spruce-fir Forest (Figure 4)

Spruce-fir Forest occurs on the steep north-facing slopes of the valley and the cover (Table A-3) is dominated by *Abies lasiocarpa* (subalpine fir) which provides 47.3 percent canopy cover. *Populus tremuloides* (aspen) and *Picea engelmannii* (Engelmann spruce) contribute 16.7 and 4.3 percent cover, respectively. *Populus tremuloides* individuals present represent the remnants of the successional cover which developed following the historic mining deforestation of the 1880's. A few large *Pseudotsuga menziesii* (Douglas-fir) are also found in this vegetation type.

Shrubs and subshrubs provide only 1.5 percent absolute cover. The major species include *Amelanchier alnifolia, Mahonia repens, Pachistima myrsinites, Physocarpus malvaceus* (mallow ninebark), *Rosa woodsii*, and *Symphoricarpos oreophilus*. Minor species present include *Rubus ideaus* (wild raspberry), *Salix bebbiana* (Bebb willow), *Sambucus caerulea, Shepherdia canadensis*, and *Sorbus scopulina* (Greene's mountain ash).

Perennial graminoids provide negligible cover. The only species commonly present are *Bromopsis porteri* (nodding brome), *Carex* sp. (sedge), and *Elymus glaucus* (blue wildrye). Other species very occasionally present include *Agropyron trachycaulum, Poa reflexa* (nodding bluegrass), *Stipa occidentalis*, and *Trisetum spicatum* (spike trisetum).

Perennial forbs comprise only 2.8 percent cover in the sampled area. The major species among them are *Aquilegia caerulea* (Colorado columbine), *Arnica cordifolia* (heartleaf arnica), *Aster engelmannii* (Engelmann aster), *Fragaria vesca* (bracted wild strawberry), *Lathyrus leucanthus* (white-flowered peavine), *Lupinus* sp. (lupine), *Orthilia secunda* (one-sided wintergreen), *Osmorhiza depauperata* (bluntseed sweetroot), *Silene menziesii* (Menzies silene), *Thalictrum* cf. *fendleri* (Fendler meadow-rue), and *Viola* cf. *adunca* (hook violet).

Minor species include *Achillea millefolium, Actaea rubra* (baneberry), *Arnica latifolia* (broadleaf arnica), *Aster* cf. *foliaceous* (leafybract aster), *Chamerion angustifolium* (fireweed), *Cirsium* sp. (thistle), *Descurainia richardsonii* (Richardson tansymustard), *Helianthella quinquenervis* (aspen sunflower), *Heuchera* sp. (alumroot), *Hieracium albiflorum* (white hawksweed), *Penstemon* sp. (beardtongue), *Senecio eremophilus* (desert groundsel), *Senecio serra* (butterweed groundsel), *Smilacina stellata, Valeriana* cf. *edulis* (edible valerian), and *Vicia americana* (American vetch).

Annual or biennial plants are essentially absent from the understory of the Spruce-fir Forest. *Moldavica parviflora* (American false dragonhead) sometimes an annual or biennial is the only species that was observed.

Cryptogams comprise a small (0.9 percent) but conspicuous cover and are comprised mainly of mosses of the widespread genera *Brachythecium* and *Hypnum*. Also conspicuous are lichens, mainly of the genera *Cladonia* and *Peltigera*. Various fungi are founc on decaying wood.

Total cover by vegetation in the Spruce-fir Forest area sampled was 73.5 percent. Cover by bare soil, litter, and rock amounted to 0.3, 25.3, and 0.9 percent, respectively.

Shrub density (Table A-15) in the Spruce-fir Forest understory totaled 3,917 stems/acre. Major contributors included *Pachistima myrsinites* (1,166 stems/acre), *Physocarpus malvaceus* (680 stems/acre), *Rosa woodsii* (583 stems/acre), *Abies lasiocarpa* seedlings and saplings, below breast height (389 stems/acre), *Populus tremuloides* saplings (259 stems/acre), and *Mahonia repens* (324 stems/acre).

Live tree density (Table A-16) totaled 574 stems/acre and dead tree density was 300 stems/acre. *Abies lasiocarpa* is the most numerous (330 stems/acre live, 93 stems/acre dead) species, followed by *Populus tremuloides* (226 stems/acre live, 207 stems/acre dead). *Picea engelmannii* is not well represented with only 15 stems/acre live (no dead *Picea* component is present). Live tree basal area (Table A-17) is dominated by *Abies lasiocarpa* (119 ft^2/acre) followed by *Picea engelmannii* (25 ft^2/acre) and *Populus tremuloides* (22 ft^2/acre).

As can be seen from Table A-15, the bulk of trees present are *Abies lasiocarpa* below 25 cm diamater at breast height (dbh) and *Populus tremuloides* between 5 and 15 cm dbh. As is typical of nearly all western spruce-fir forests, *Picea engelmannii*, although representing only a small part of total live stem density (2.6%), has a much larger proportion of live basal area (14.8%). See Table A-16.

A few large *Picea engelmannii* and *Pseudotsuga menziesii* exist scattered throughout the Spruce-fir Forest type. These trees, measuring about 18 inches (45 cm) to 24 inches (60 cm) dbh are apparently survivors of the deforestation of the late 1870's and 1880's since their ages (sampled by increment borer at breast height) were about 118 years. At the time of deforestation these individuals would have been 2 inches (5 cm) to 3 inches (7.5 cm) in diameter, and probably were deemed of no use for mine timber.

The next largest *Abies lasiocarpa* and *Picea engelmannii* (about 12 inches or 30 cm dbh) have ages of 90 to 100 years, suggesting that of the coniferous growth present now, most represents regrowth following the years of cutting for use in the Winter Quarters Mines and facilities.

As mentioned before, photographs from 1900 show a heavy growth of *Populus tremuloides* on the north-facing slopes such as would be expected following removal of the dominant conifer cover. 1916 photographs show conifer regrowth under and emerging above the *Populus tremuloides* cover. The *Populus tremuloides* present now are very tall and thin with little foliage except near the uppermost part of the trees, the result of competition for light with the growing conifer cover.

The heights of the largest *Picea engelmannii* and *Pseudotsuga menziesii* range from 90 to 100 feet (28 to 30 m). The heights of most of the regrowth is no more than about 80 feet (25 m).

Aspen Forest (Figure 5)

This vegetation type is present in the Scofield Mine project area but is not subject to disturbance by planned operations. It is dominated by *Populus tremuloides* (quaking aspen). Most of the Aspen Forest stands in the study area are successional to spruce-fir forests with the possible exception of those marginal stands present on south-facing slopes. On north-, east-, and west-facing slopes, the stands examined had conifers, mostly *Abies lasiocarpa* but some *Picea engelmannii*, developing in the understory and protending eventual conifer dominance such as has developed on the very steep north-facing slopes already. Occasional *Juniperus scopulorum* (Rocky Mountain juniper) also occur in the Aspen Forest stands.

Shrubs and subshrubs are conspicuous members of the understory in Aspen Forest stands. *Symphoricarpos oreophilus* is by far the major shrub present. *Amelanchier alnifolia, Lonicera involucrata, Mahonia repens, Pachistima myrsinites, Prunus virginiana* var. *melanocarpa, Rosa woodsii, Ribes viscosissimum, Salix bebbiana*, and *Shepherdia canadensis* are also frequently present.

Perennial graminoids are also abundant in the understory of Aspen Forest. *Poa pratensis* is the most abundant graminoid but *Bromopsis ciliata, Bromopsis porteri, Carex geyeri, Elymus glaucus, Stipa lettermanii*, and *Stipa occidentalis* are also common. *Agropyron trachycaulum, Poa nemoralis* ssp. *interior*, and *Phleum pratense* occur occasionally.

Of the numerous perennial forbs occurring in the Aspen Forest understory, the most abundant are *Fragaria vesca, Helianthella quinquinervis, Lathyrus leucanthus, Penstemon* spp., *Silene menziesii*, and *Smilacina stellata*. Present occasionally are *Aster engelmannii, Aster* cf. *occidentalis, Chamerion angustifolium, Dugaldia hoopesii, Frasera speciosa* (green gentian), *Galium trifidum, Hieracium albiflorum, Hackelia floribunda, Osmorhiza depauperata, Potentilla pulcherrima* ssp. *gracilis* (northwest cinquefoil), and *Senecio eremophilus*

Annual forbs present include *Chaenactis douglasii* (false yarrow) and *Gentianella amarella* (annual gentian).

3.2.5 Plant Species List

The species list (Table A-18) provides the scientific and "common" (i.e., ang cized) names of the 218 species, subspecies, and varieties observed in the Scofield Mine study area. Cryptogams listed are only some of the most conspicuous forms. No thorough cryptogamic survey was attempted nor was any required. Table A-18 also includes information on the native or introduced status of the species and the vegetation type in which they can be expected to occur.

During the course of sampling, several species of *Penstemon* were encountered whose separation is not feasible without specimens in particular stages of flowering and/or fruiting. Consequently, the entry in the data tables reads *Penstemon* spp. Species included in that group include *P. cyathophorus*, *P. radicosus*, *P. rydbergii*, *P. strictus*, *P. watsonii*, and *P. whippleanus*, although it was occasionally possible to identify the latter species by itself.

As stated in Section 2.0, plant nomenclature follows the approved nomenclature of Weber and Johnston (1979). The one exception is *Galium tinctorium* L. which does not appear in the latter reference and the reader is referred to McDougall (1973) for published record of this species in the area.

No attempt was made to separate the native *Poa agassizensis* Boivin et D. Loeve from the introduced *Poa pratensis* L. Many taxonomists (e.g., Cronquist et al. 1977) doubt the taxonomic difference between the two and field separation based on published descriptions (see Weber 1976) has not proven consistently satisfactory. Nonetheless, it seems likely that a large part of what has been called *Poa pratensis* in this study is actually native in origin.

3.2.6 Total Acres in Project Area

The Scofield Mine project area includes a total of 696.7 acres.

3.2.7 Acreages of Vegetation Types to be Disturbed

Listed in Table 4 are the acreages of each vegetation type in the project area and the affected area.

TABLE 4

ACREAGE IN EACH VEGETATION TYPE
IN PROJECT AND AFFECTED AREAS
SCOFIELD MINE PROJECT

Vegetation Type	Acres	
	Project Area	Affected Area
Aspen Forest	302.1	-
Mountain Shrubland	293.9	21.5
Riparian Meadow and Shrubland	15.4	3.1
Spruce-fir Forest	83.7	0.8
Hayland	0.3	0.5
Urban Area	1.3	0.6
Total	696.7	26.5

3.2.8 Reference Area Supporting Data

3.2.8.1 Description

Mountain Shrubland Reference Area (Figure 6)

Cover in this reference area (Table A-4) is dominated by shrubs and subshrubs which comprise 55.1 percent absolute cover (75.8 percent of the vegetational cover). The most abundant shrubs are *Artemisia tridentata* ssp. *vaseyana* with 28.8 percent cover, *Symphoricarpos oreophilus* with 15.1 percent cover, and *Amelanchier alnifolia* with 6.4 percent cover. Other shrubs present in smaller amounts include *Chrysothamnus nauseosus*, *Chrysothamnus viscidiflorus*, *Mahonia repens*, *Pachistima myrsinites*, *Prunus virginiana* var. *melanocarpa*, *Purshia tridentata*, *Rosa woodsii*, and *Tetradymia canescens* (gray horsebrush).

Next to shrubs and subshrubs, perennial graminoids are the next most abundant life form with 13.2 percent cover. The major species are *Poa pratensis* with 3.6 percent cover, *Agropyron spicatum* with 2.8 percent cover, *Carex geyeri* with 1.6 percent cover, and *Agropyron albicans* with 1.5 percent cover. Other species present include *Agropyron trachycaulum*, *Bromopsis ciliata*, *Bromopsis porteri*, *Poa ampla* (big bluegrass), *Poa fendleriana*, *Stipa lettermanii*, *Stipa occidentalis*, and *Stipa viridula*.

Perennial forbs comprise only 4.4 percent cover of which most is contributed by *Artemisia ludoviciana*, *Aster chilensis*, and *Penstemon* spp. Minor species include *Achillea millefolium*, *Castilleja linariaefolia*, *Cirsium neomexicanum* (New Mexico thistle), *Eriogonum subalpinum*, *Eriogonum umbellatum* (sulphur wildbuckwheat), *Geranium viscosissimum* (sticky geranium), *Machaeranthera canescens*, *Mertensia oblongifolia* (oblongleaf bluebells), *Smilacina stellata*, *Solidago sparsiflora* (few-flowered goldenrod), *Urtica dioica*, and *Vicia americana*.

Total percent cover in the Mountain Shrubland reference area is 72.7 percent. Bare soil, litter, and rock cover values are 9.9, 13.3, and 4.1 percent, respectively.

Production in the Mountain Shrubland reference area (Table A-8) totals 587 lbs/acre, oven-dry. Graminoid production totals 364 lbs/acre of which most is provided by *Agropyron spicatum* (127 lbs/acre) and *Poa pratensis* (112 lbs/acre). Lesser amounts of production are accounted for by *Carex geyeri* (45 lbs/acre), *Poa ampla* (34 lbs/acre), and *Stipa lettermanii* (26 lbs/acre). Forb production totaled 223 lbs/acre.

Shrub density in the Mountain Shrubland reference area (Table A-12) totals 9,737 stems/acre. Major contributing species are *Symphoricarpos oreophilus* (3,572 stems/acre), *Artemisia tridentata* ssp. *vaseyana* (2,949 stems/acre), *Amelanchier alnifolia* (1,190 stems/acre), and *Rosa woodsii* (720 stems/acre).

Riparian Meadow and Shrubland Reference Area (Figure 7)

Cover in the Riparian Meadow and Shrubland reference area (Table A-5) is dominated by perennial graminoids which total 43.1 percent cover. Major contributors to this cover include *Poa pratensis* with 11.3 percent cover, *Juncus arcticus* ssp. *balticus* with 8.3 percent cover, *Agrostis gigantea* with 5.7 percent cover, *Carex praegracilis* with 2.9 percent cover, and *Agropyron trachycaulum* with 2.8 percent cover. Other species present include *Agropyron spicatum, Bromopsis ciliata, Bromopsis porteri, Calamagrostis canadensis, Carex microptera, Carex nebrascensis, Carex utriculata, Elymus glaucus, Festuca pratensis, Glyceria striata* (fowl mannagrass), *Hordeum brachyantherum, Juncus tracyi, Muhlenbergia richardsonis, Phleum pratense, Poa palustris, Stipa lettermanii, Stipa occidentalis,* and *Trisetum spicatum.*

Shrubs and subshrubs comprise the next most abundant life form (18.4 percent cover). Species providing the major portions of cover include *Salix* cf. *caudata* with 7.3 percent cover, *Salix subcoerulea* with 4.7 percent cover, and *Symphoricarpos oreophilus* with 2.5 percent cover. Other species present include *Artemisia tridentata* ssp. *vaseyana, Chrysothamnus viscidiflorus, Lonicera involucrata, Ribes cereum, Rosa woodsii, Rubus idaeus* (wild raspberry), *Salix exigua, Salix lasiandra,* and *Shepherdia canadensis.* While somewhat less cover by shrubs is present in the reference area compared to the affected area, somewhat greater tree cover is present (5.5 percent). This total is comprised of 3.6 percent cover by *Picea engelmannii* and 1.9 percent cover by *Abies lasiocarpa.*

Perennial forbs are rather abundant, totaling 18.0 percent cover. Major contributors to this total include *Urtica dioica* with 5.3 percent cover, *Geranium richardsonii* with 3.1 percent cover, *Achillea lanulosa* with 1.2 percent cover, *Cirsium flodmanii* with 1.2 percent cover, *Cirsium undulatum* with 0.9 percent cover, and *Aster* cf. *occidentalis* (western aster) with 0.8% cover. Other species include *Aquilegia caerulea, Angelica* sp. (angelica), *Antennaria rosea, Arnica cordifolia, Artemisia dracunculus* (false tarragon), *Artemisia ludoviciana, Descurainia richardsonii, Dugaldia hoopesii, Fragaria vesca, Galium boreale* (northern bedstraw), *Geum macrophyllum, Hackelia floribunda, Heliomeris multiflora* (showy goldeneye), *Ipomopsis aggregata, Lathyrus leucanthus, Mentha arvensis, Mimulus guttatus, Penstemon* spp., *Phacelia hastata* (spear-shaped phacelia), *Polemonium foliosissimum* (leafy polemonium), *Rudbeckia occidentalis, Rumex crispus* (curly dock), *Saxifraga odontoloma, Senecio serra, Silene menziesii, Smilacina stellata, Taraxacum officinale* (common dandelion), *Thalictrum* cf. *fendleri, Tragopogon dubius* (yellow salsify), *Trifolium hybridum* (alsike clover), *Verbascum thapsus* (flannel mullein), and *Viola* cf. *adunca.*

Annual forbs (0.3 percent cover) present include *Capsella bursa-pastoris* (shepherds purse), *Cynoglossum officinale, Epilobium paniculatum, Lepidium densiflorum* (prairie pepperweed), and *Polygonum douglasii* (Douglas knotweed).

Cover by cryptogams totaled 3.1 percent, most of which is *Equisetum arvense* (1.9 percent cover) and mosses (1.1 percent cover).

Total cover in the Riparian Meadow and Shrubland reference area is 88.3 percent. Bare soil, litter, and rock cover values are 5.7, 4.4, and 1.6 percent, respectively.

Production (Table A-9) totaled 1,861 lbs/acre, oven-dry. Graminoid production totaled 1,544 lbs/acre. Major graminoid producers were *Juncus arcticus* (517 lbs/acre), *Poa pratensis* (463 lbs/acre), *Agrostis gigantea* (137 lbs/acre), *Carex praegracilis* (133 lbs/acre), and *Carex utriculata* (95 lbs/acre). Forb production totaled 317 lbs/acre.

Woody plant density (Table A-13) totaled 1,743 stems/acre. Major species in this total are *Salix* cf. *caudata* (631 stems/acre), *Salix subcoerulea* (348 stems/acre), *Rubus idaeus* (264 stems/acre), *Ribes cereum* (173 stems/acre), and *Symphoricarpos oreophilus* (103 stems/acre).

Tree inventory data from the Riparian Meadow and Shrubland reference area are present in Table A-14. A total of 109 live trees above breast height (4.25 ft or 1.3 m) are present in the reference area. Most are *Picea engelmannii* below 4 inches (10 cm) dbh.

3.2.8.2 Comparison of Reference Area to Affected Area

The Mountain Shrubland affected and reference areas were compared for cover values using the Sorensen index of similarity (Mueller-Dombois and Ellenberg 1974) which is 2W ÷ A+B where W is the smallest sum of cover values of common species and A and B are the total vegetational cover values. The result was an index of similarity of 83.9 percent.

The affected and reference areas were also compared using a confidence limit test,

$$|\bar{x}_1 - \bar{x}_2| \quad \text{compared to} \quad t\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

where $\bar{x}_1$ = the mean of the affected area

$\bar{x}_2$ = the mean of the reference area

s_1^2 = variance of the mean in the affected area

s_2^2 = variance of the mean in the reference area

n_1 = the number of samples taken in the affected area or the minimum number of samples needed to achieve sample adequacy (n_{min}), whichever is smaller

n_2 = the number of samples taken in the reference area or the minimum number of samples needed to achieve sample adequacy (n_{min}), whichever is smaller

t = a two-tailed t value for confidence level of 90 percent or greater, with appropriate (n_1 + n_2) degrees of freedom

If the left-hand term (difference of means) is less than the right-hand expression (adjusted standard error), then the means are not statistically different.

Using the above formula, cover mean values for the Mountain Shrubland reference and affected areas are shown not to be different at the 99.9 percent confidence level. Likewise, mean shrub density values are not different at the 99.9 percent confidence level. Mean production values are shown not to be different at the 90 percent confidence level. Therefore, it is believed that the affected area and control area can be deemed comparable.

Using the same techniques in comparison of the Riparian Meadow and Shrubland affected and reference areas, the similarity index value is 98.6. Cover, shrub density, and production values are all shown to be no different, using the formula above, at the 90% confidence level.

3.2.9 Sample Characteristics and Adequacy

Table 5 presents an evaluation of sample adequacy for the affected and reference area samples. In all cases, either adequacy was met or maximum sample size of 50 was achieved. Note that, as is usually the case, cover data easily met adequacy, while density data were variable, and production data minimum sample sizes were usually much greater than fifty.

TABLE 5

SAMPLE CHARACTERISTICS AND ADEQUACY
SCOFIELD MINE VEGETATION STUDY

Vegetation Type	Production (g/m^2)				Total Vegetation Cover (%)				Stem Density (no./50 m^2)			
	mean	SD[a]	n	n_{min}	mean	SD[a]	n	n_{min}	mean	SD[a]	n	n_{min}
Mountain Shrubland												
Affected[b]	62.2	47.8	50	97	55.6	10.7	20	6	83.1	26.0	49	16
Reference[b]	65.9	38.3	30	55	72.7	5.8	15	1	119.1	41.1	30	20
Riparian Meadow and Shrubland												
Affected[b]	212.9	102.9	50	38	82.7	10.1	20	3	27.4	20.6	50	93
Reference[c]	208.8	128.6	30	101	88.3	6.2	15	2	21.5	14.8	30	127
Spruce-fir Woodland												
Affected[b]	–	–	–	–	73.5	9.6	15	3	55.4[d]	16.2	15	14

[a] Standard Deivation (n-1)

[b] Qualifies as shrubland; 80% confidence level used in statistics

[c] Qualifies as non-shrubland; 90% confidence level used in statistics

[d] Spruce-fir Forest shrub data (no./25 m^2) and live tree data (no./125 m^2) combined as no./50 m^2 for adequacy determination

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Total cover in the Riparian Meadow and Shrubland reference area is 88.3 percent. Bare soil, litter, and rock cover values are 5.7, 4.4, and 1.6 percent, respectively.

Production (Table A-9) totaled 1,861 lbs/acre, oven-dry. Graminoid production totaled 1,544 lbs/acre. Major graminoid producers were *Juncus arcticus* (517 lbs/acre), *Poa pratensis* (463 lbs/acre), *Agrostis gigantea* (137 lbs/acre), *Carex praegracilis* (133 lbs/acre), and *Carex utriculata* (95 lbs/acre). Forb production totaled 317 lbs/acre.

Woody plant density (Table A-13) totaled 1,743 stems/acre. Major species in this total are *Salix* cf. *caudata* (631 stems/acre), *Salix subcoerulea* (348 stems/acre), *Rubus idaeus* (264 stems/acre), *Ribes cereum* (173 stems/acre), and *Symphoricarpos oreophilus* (103 stems/acre).

Tree inventory data from the Riparian Meadow and Shrubland reference area are present in Table A-14. A total of 109 live trees above breast height (4.25 ft or 1.3 m) are present in the reference area. Most are *Picea engelmannii* below 4 inches (10 cm) dbh.

3.2.8.2 Comparison of Reference Area to Affected Area

The Mountain Shrubland affected and reference areas were compared for cover values using the Sorensen index of similarity (Mueller-Dombois and Ellenberg 1974) which is 2W ÷ A+B where W is the smallest sum of cover values of common species and A and B are the total vegetational cover values. The result was an index of similarity of 83.9 percent.

The affected and reference areas were also compared using a confidence limit test,

$$|\bar{x}_1 - \bar{x}_2| \quad \text{compared to} \quad t\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

where $\bar{x}_1$ = the mean of the affected area

$\bar{x}_2$ = the mean of the reference area

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	mean	SD[a]	n	n_{min}	mean	SD[a]	n	n_{min}	mean	SD[a]	n	n_{min}
Mountain Shrubland												
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Reference[c]	208.8	128.6	30	101	88.3	6.2	15	2	21.5	14.8	30	127
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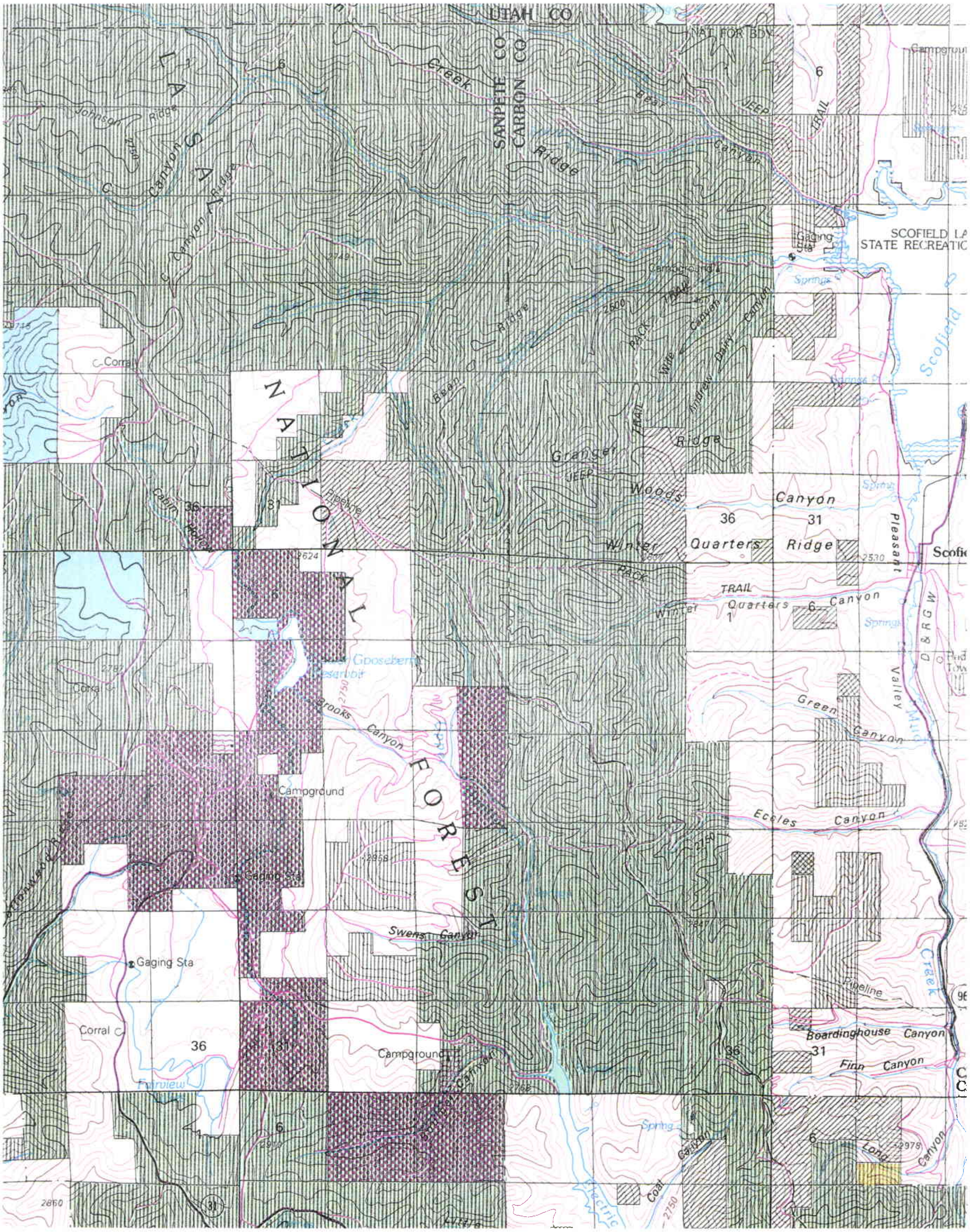
[d]Spruce-fir Forest shrub data (no./25 m^2) and live tree data (no./125 m^2) combined as no./50 m^2 for adequacy determination

4.0 THREATENED OR ENDANGERED PLANT SPECIES

Of plants currently listed by the U.S. Fish and Wildlife Service (1980) as threatened or endangered in Utah, none occur on the Scofield Project site or even in Carbon County. Of plants listed as currently under review by the U.S. Fish and Wildlife Service (1980), two that occur in Carbon County are present in Category 2 status, meaning that information for these species "indicates the probable appropriateness of listing as endangered or threatened" but which is not sufficient to biologically support such designation. The two species in this category listed for Carbon County are Davidse Buckwheat (*Eriogonum corymbosum* Benth. var. *davidsei* Reveal) and Lanceleaf Buckwheat (*Eriogonum lancifolium* Reveal and Brotherson). Both of these species are found on clay soils derived from Mancos shale in desert shrub vegetation between 5,000 and 6,000 feet elevation (Welsh 1979). Since the project site soils are derived from sediments younger than Mancos shale, the vegetation is Mountain Shrubland, Riparian Meadow and Shrubland, Spruce-fir Forest, and Aspen Forest and the elevations are around 8,000 feet, there is little likelihood of the occurrence of these buckwheat species on the Scofield Project site. Furthermore, no specimens were observed during field studies.

LAND STATUS AND MINERAL OWNERSHIP



SCALE 1:100 000

1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND

CONTOUR INTERVAL 50 METERS

LAND STATUS AND MINERAL OWNERSHIP (BLM)

EarthFax

MINERALS OWNED BY THE FEDERAL GOVERNMENT

All minerals . . . .

Coal only . . . .

Oil and Gas only . . . .

Oil, Gas and Coal only . . . .

Other . . . .

No symbol indicates no Federal minerals . . . .

BUREAU OF LAND MANAGEMENT

LAND STATUS LEGEND

Bankhead-Jones Land Use Lands (L.U. Lands) . . . . NONE

Tennessee Valley Authority . . . . NONE

Patented Lands . . . .

State Lands . . . .

Bureau of Reclamation . . . .

Power Withdrawals and Classifications. . . . .

Federal Agency Protective Withdrawals. . . . .

Public Water Reserves. . . . .

Public Lands (Administered By Bureau of Land Management) . . . . .

Oregon & California Lands (O&C Lands) Coos Bay Wagon Road (CBWR) . . . . NONE

National Forest. . . . .

National Grasslands . . . . NONE

National Parks and Monuments . . . . NONE

Indian Lands or Reservations . . . . . . NONE

Military Reservations and Withdrawals Corps of Engineers . . . . NONE

Wildlife Refuges . . . . NONE

Department of Energy (DOE). NONE

Oregon & California Lands (O&C Lands) Administered By US Forest Service . NONE

Radio & Air Facilities . . . . NONE

Miscellaneous . . . . NONE

State, County, City, Wildlife, Park and Outdoor Recreation Areas. .

Acquired Lands (By Administering Agency) . . . .

BLM EDITION–1982

BUREAU OF LAND MANAGEMENT

SURFACE MANAGEMENT STATUS
MINERAL MANAGEMENT STATUS

1:100 000-scale *metric* topographic map of

Nephi

UTAH

30 X 60 MINUTE QUADRANGLE SHOWING

PAGE 2 OF 2

EarthFax

MANTI-LA SAL FOREST -- PRICE RANGER DISTRICT
SHEEP GRAZING ALLOTMENT DATA

SM = Sheep Month
HM = Head Month

750 7/16 - 9/25

Firmed up 1749 SM

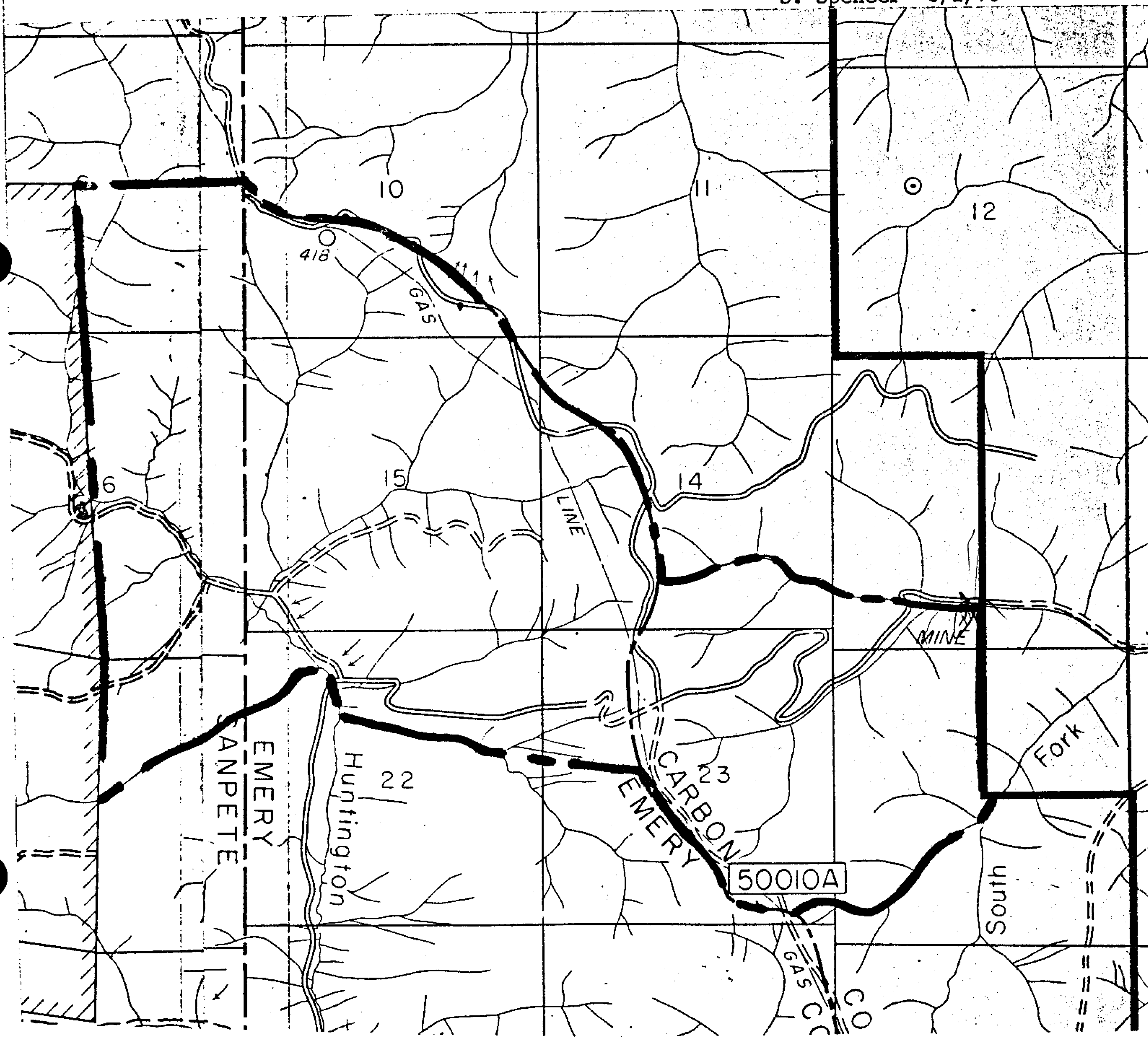
Page ____________ of ____________

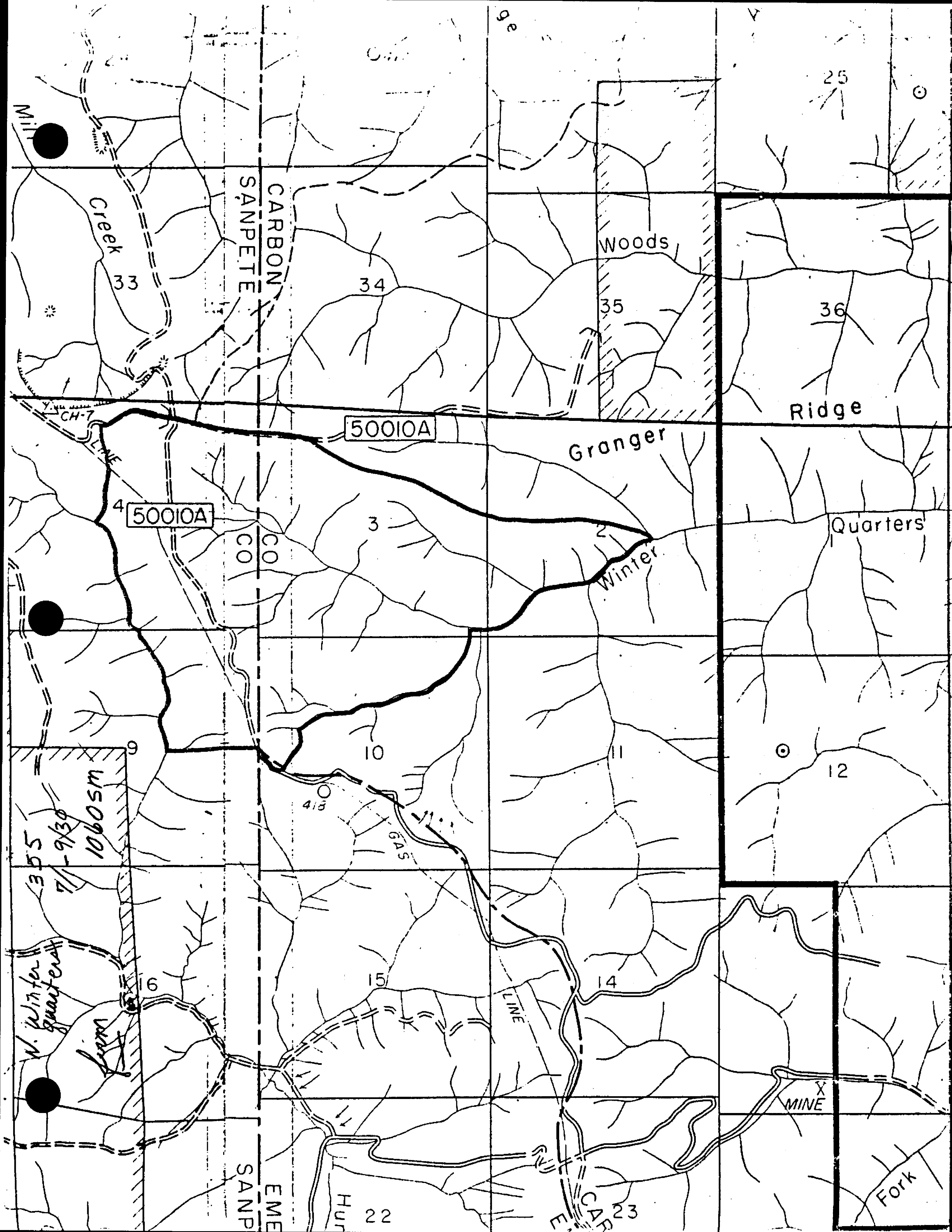
Permit Number ________________

MANTI-LASAL FOREST -- PRICE RANGER DISTRICT
FR AREA 324 -- ECCLES ALLOTMENT

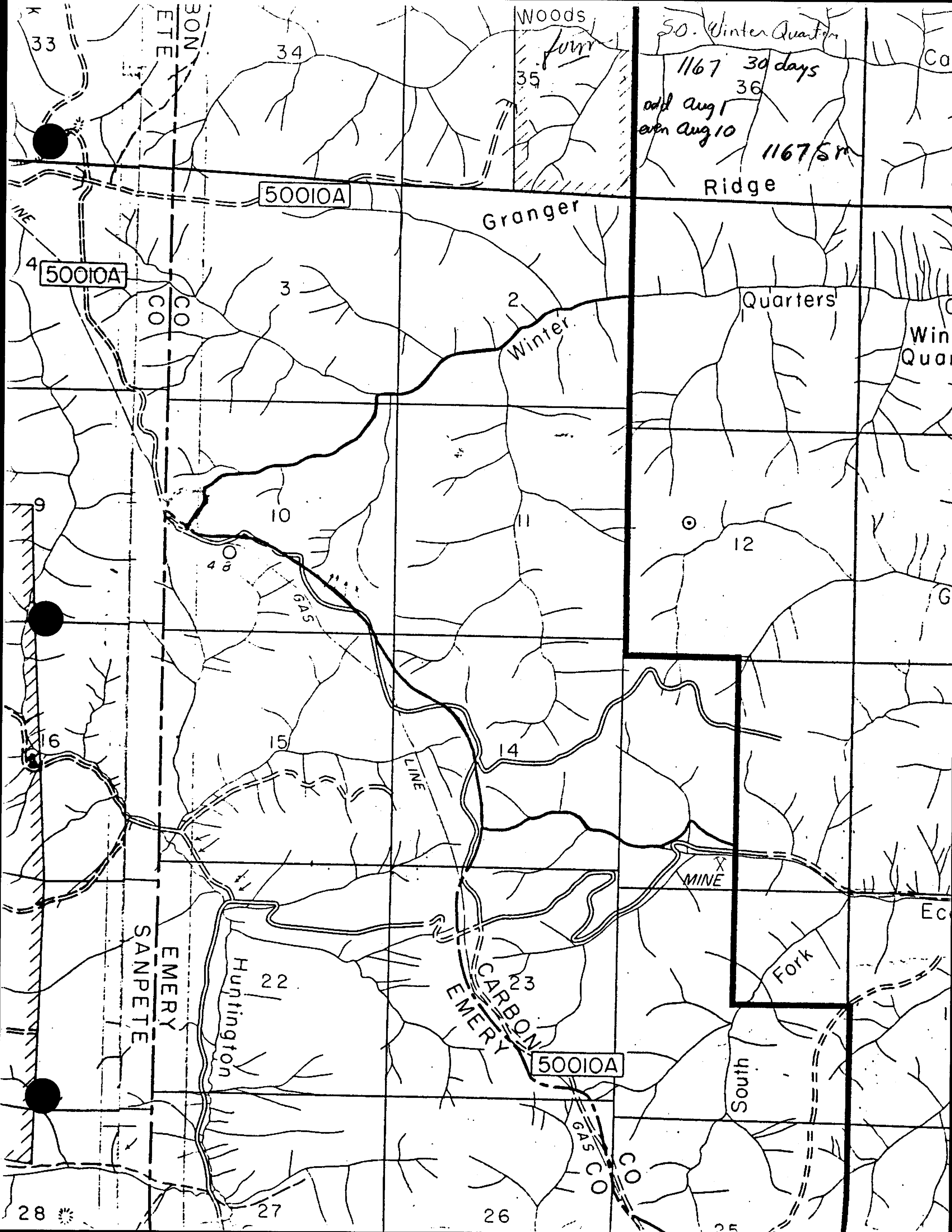
This is a map of the Eccles Allotment. It shows the area you are authorized to graze in Grazing Permit No. ________________ issued to ________________ by the Forest Supervisor of the Manti LaSal National Forest on ____________.

S. Spencer 5/1/79





CARBON
SANPETE
Creek
33
34
35
36
25
Woods
Ridge
Granger
Quarters
Winter
50010A
50010A
CH-7
LINE
4
3
2
CO
CO
9
10
11
12
GAS
15
16
14
LINE
MINE
Fork
22
23
355
7/1-9/30
1060sm
N. Winter quarters



So. Winter Quarter
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odd Aug 1
even Aug 10
1167 SM
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34
35
36
50010A
Granger
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4
3
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CO
Winter
Quarters
9
10
11
12
48
GAS
LINE
16
15
14
MINE
Fork
South
EMERY
SANPETE
Huntington
22
23
CARBON
EMERY
GAS
CO
CO
28
27
26

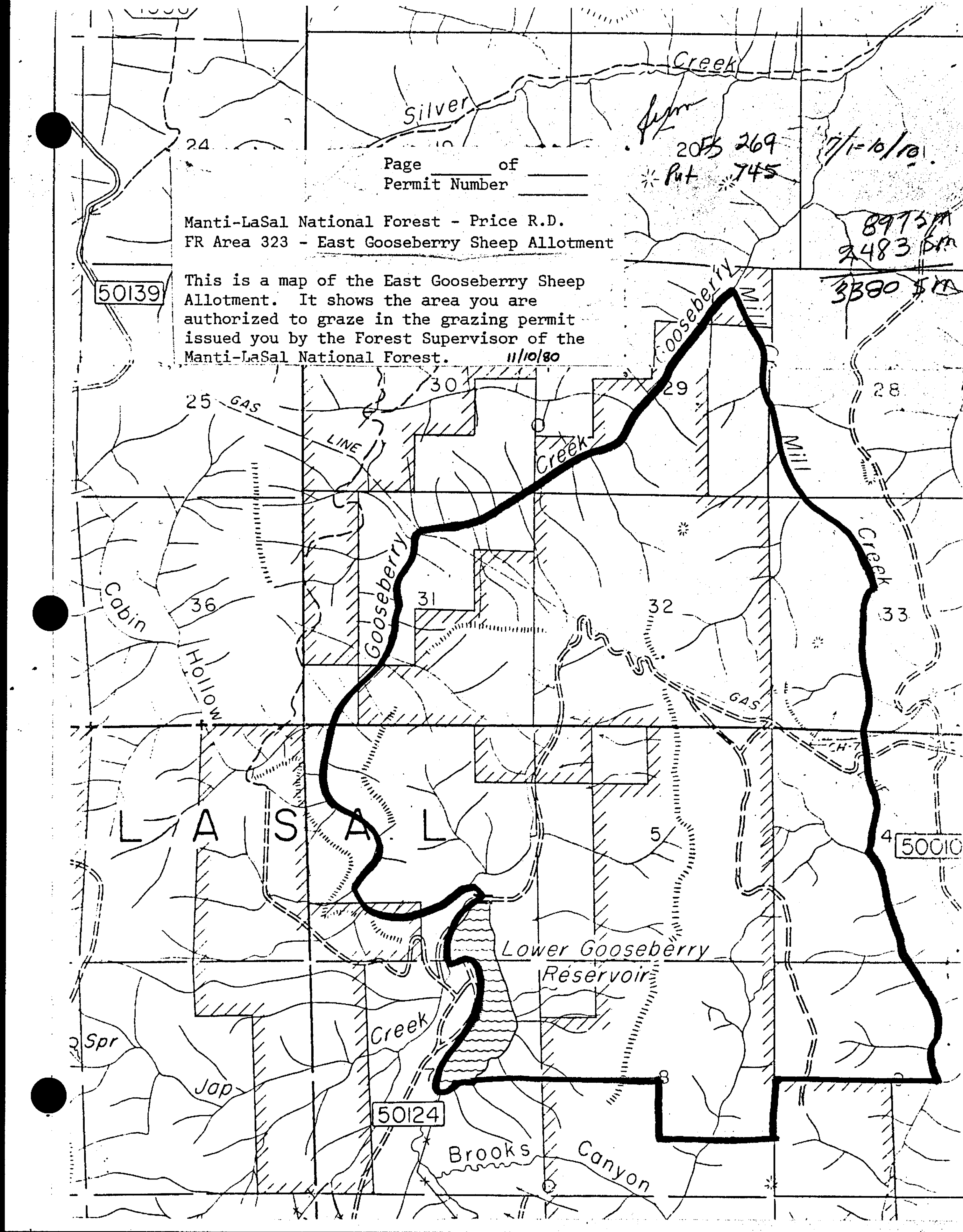
Page ______ of ______
Permit Number ______

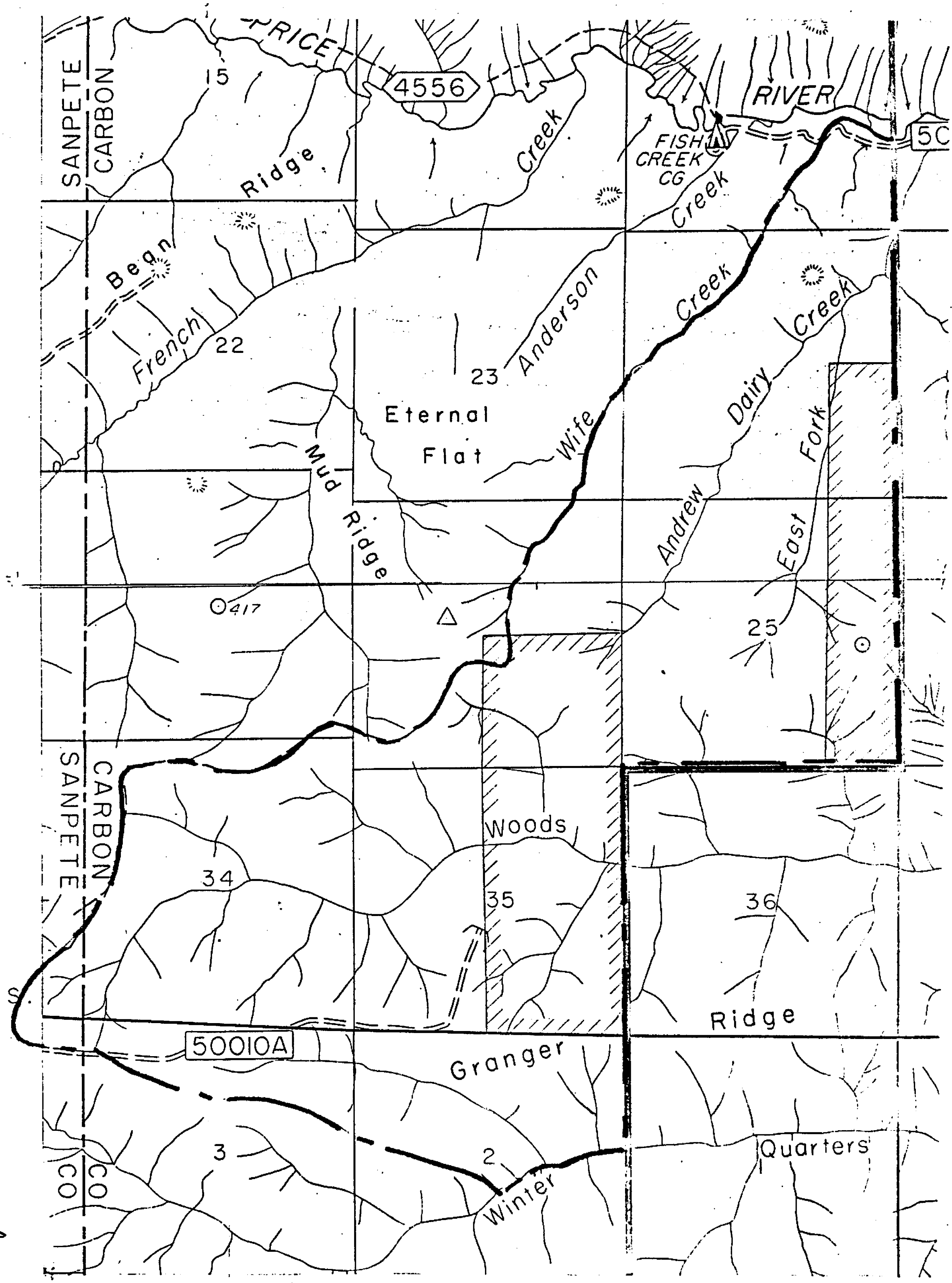
Manti-LaSal National Forest - Price R.D.
FR Area 323 - East Gooseberry Sheep Allotment

This is a map of the East Gooseberry Sheep Allotment. It shows the area you are authorized to graze in the grazing permit issued you by the Forest Supervisor of the Manti-LaSal National Forest. 11/10/80

7/1-10/10

8973 SM
2483 SM
3380 SM

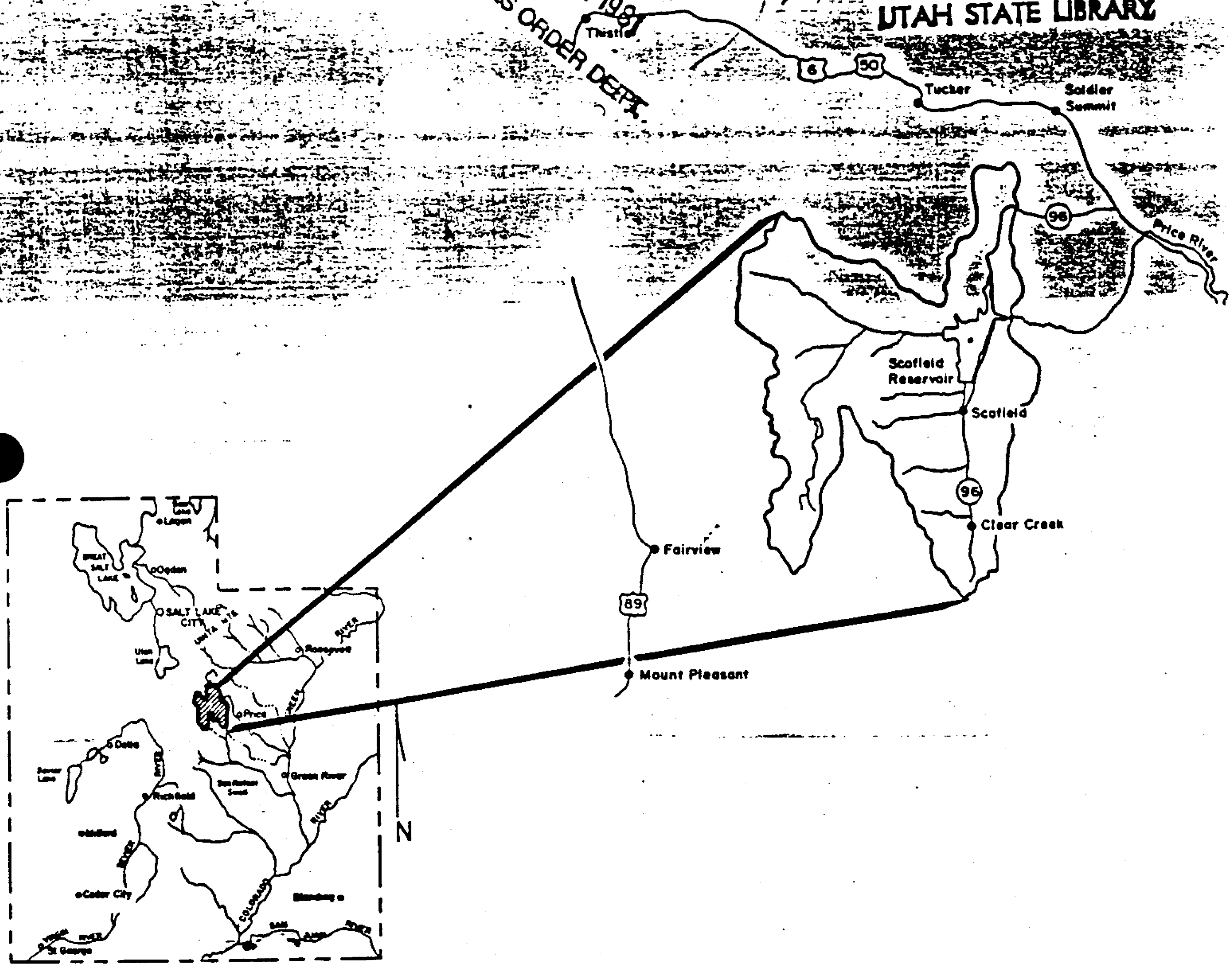




Granger Ridge 7/1- 9/30
1036
Lem 3109 Sm

Water Quality In Pleasant Valley, Utah

Calvin G. Clyde
Dennis B. George
Kun Mo Lee
Phil Pucel
William Hay



Utah Water Research Laboratory
Utah State University
Logan, Utah 84322

March 1981

Hydrology and Hydraulics Series
UWRL/H-81/02

Table 2. Sheep allotments on the Manti-LaSal National Forest in the Pleasant Valley, Utah.

Allotment Name	Allotment	Dates
Bob Wright	1,013	July 1 to Sept. 30
Yellow Brush Flat and Trough Spring Ridge	1,849	July 1 to Sept. 30
Mon Peak	601	July 1 to Sept. 30
Coal Ridge	377	July 6 to Sept. 25
Burnout	678	July 1 to Sept. 25
Eccles	1,000	July 1 to Sept. 30
Bean Ridge	1,000	July 1 to Sept. 30
French Creek	1,156	July 1 to Sept. 30
Granger Ridge	1,156	July 1 to Sept. 30
Winter Quarters	848	July 1 to Sept. 30
Bennion	656	July 1 to Sept. 30
W. Bear	663	July 1 to Sept. 30
W. Fish Creek	897	July 1 to Sept. 30
E. Fish Creek	991	July 1 to Sept. 30
C Canyon	900	July 1 to Sept. 30
Silver Creek	936	July 1 to Sept. 30
Cabin Hollow	1,050	July 1 to Sept. 30
E. Gooseberry	269	July 1 to Oct 30
Mansion	727	July 1 to Oct. 30
Johnson Ridge	684	July 1 to Sept. 30
Pondtown	1,417	July 1 to Sept. 30
E. Bear Ridge	1,200	June 11 to Sept. 30

(Personal communication: USFS: Manti-LaSal National Forest 1980)

Recreation is characterized by boating and fishing in the summer, hunting in the fall, snowmobiling and cross-country skiing during the winter.

Population

The population of the town of Scofield and of the summer home develoments varies widely between the summer and winter seasons. Scofield boasts a year-round residency of 35, which increases to 150 during the summer months. The average family size is 3.18 people per household. The summer home developments are vacated during the winter and early spring, with the peak population occurring between Memorial Day and Labor Day (Southeastern Utah Association of Governments 1980). Bolotas subdivision and the County Street subdivision at the north end of the lake and Perry's boat camp just south of the outlet provide space for housing, camping, and other facilities mostly for summertime recreational use. A few residents stay all year. Some additional year-round homes are located in the settlement at Clear Creek and other scattered locations.

A State Park, which hosted 125,000 visitors during the summer of 1979, is located south of the county subdivision on the shoreline of the reservoir. Facilities include two trailers used as living quarters for the state rangers, parking area, a water supply obtained from a nearby 42 m (140 ft) well, a boat ramp, restrooms and a fish-cleaning station.

WOOD CANYON 20
WINTER QUARTER 12, 13, 28
GREEN CANYON 11
ECCLES CANYON 10
Fish Creek 26, 23

LAND USE
SKYLINE MINES
MINING AND RECLAMATION PLAN
VOLUME 1, 1992

SKYLINE MINES

MINING AND RECLAMATION PLAN

COASTAL STATES ENERGY COMPAN

1992

VOLUME 1

2.12 LAND USE

INTRODUCTION

The Skyline property, located in the northern end of the Wasatch Plateau coal field, is the site of a system of underground coal mines developed by Coastal States Energy Company. The general area of the Skyline property lies within both Carbon and Emery counties in T13S and R6E, approximately seventy-eight air miles southeast of Salt Lake City, Utah and twenty-two air miles northwest of Price, Utah (refer to Figure 2.12-A). The leasehold includes approximately 6,290 acres of land, of which 6,220 acres are located within the Manti-LaSal National Forest. The remaining seventy acres are coal rights leased from Carbon County. The portal and yard area are located in Eccles Canyon just west of and within the National Forest boundary line. A Utah State highway (SR-264) runs past the portal yard area east down Eccles Canyon to a coal loadout facility located at the canyon mouth. A conveyor system parallels the road from the mine to the loadout facility at the mouth of Eccles Canyon.

2.12.1 Existing Land Uses

Pre-mining land uses of the Skyline property and adjacent area consist of grazing, recreation, natural gas transmission and forestry.

Grazing

Four National Forest Sheep allotments are contained partially within the lease area (refer to Map 2.12.1-1). The numbers of livestock and season of use data for each allotment are contained in Table 2.12.1-1.

Private lands east of the National Forest boundary are grazed by similar numbers of sheep both before and after 7/1 to 9/30 (U.S. Geological Survey, 1979).

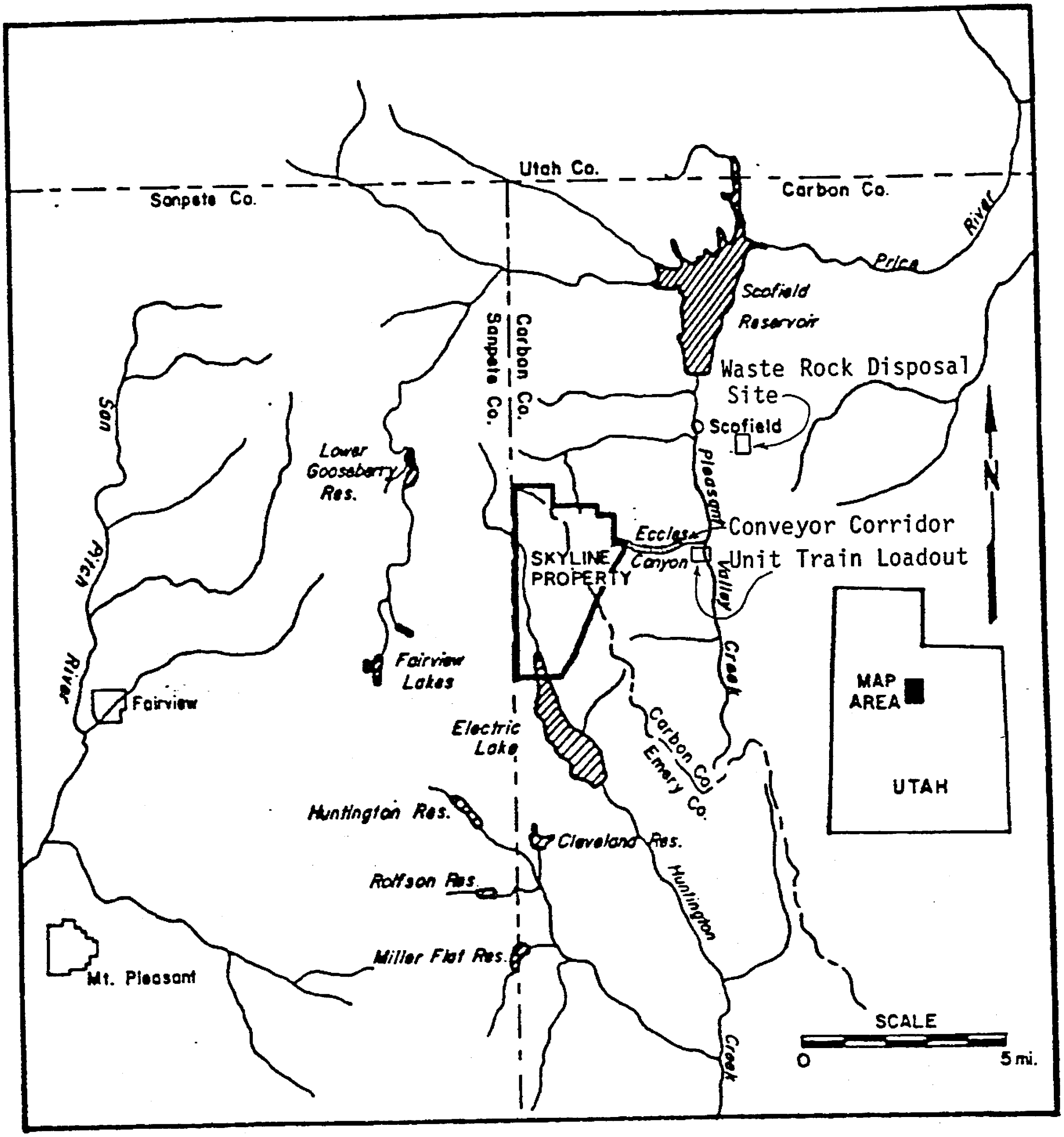


Figure 2.12-A

Location of Skyline Project Area

TABLE 2.12.1-1

SHEEP ALLOTMENT DATA FOR THE FOUR ALLOTMENTS CONTAINED PARTIALLY WITHIN THE COAL LEASE AREA FOR THE PROPOSED SKYLINE MINE

Allotment	Sheep Numbers	Season of Use
Winter Quarters	459	7/1 - 9/30
Eccles Canyon	1000	7/21 - 9/15
Burnout	678	7/1 - 9/25
Coal Ridge	586	7/6 - 9/25

Recreation

Recreational use of the lease area affected by surface operations consists primarily of hunting big game, game birds, and small game species; fishing in Eccles Canyon below the portal area; from the south fork to the mouth of the canyon sightseeing, snowmobiling, and cross country skiing. Limited camping and picnicking also occurred in the mouth of Eccles Canyon (U.S. geological Survey, 1979).

Eccles Canyon Road provides the only direct access from Scofield Reservoir to Huntington Canyon and is used as an access route from the Scofield Reservoir recreation area to the recreational use areas at higher elevations in the northern end of the Wasatch Plateau (U.S. Geological Survey, 1979).

Natural Gas Transmission

A natural gas pipeline traverses the permit area from southeast to northwest. The original gas pipeline was abandoned and a new line was relocated in 1990. A gas tank associated with the transmission line is immediately southeast of the permit boundary. Additionally, an abandoned gas well is located in the Eccles Canyon portion of the permit area. A small building associated with Gas Well No. 8 is located in Eccles Canyon. The location of these features are all shown on Map 2.12.1-1.

Forestry

Forest uses are limited primarily to cutting firewood and fenceposts. Occasional timber sales from National Forest lands are made to salvage insect-killed spruce timber. One such sale, totalling 2.5 million board feet, was made in the Kitchen Creek drainage basin on the west side of the coal lease area in 1977.

2.12.2 Capability and Productivity of the Permit Area Affected by Surface Operations and Facilities

Portions of the permit area affected by surface operations and facilities of the underground Skyline Mines are capable of supporting limited forestry, grazing, and recreational uses. Farming in the area is prohibited by the steep and rocky terrain of Eccles Canyon.

FORESTRY AND GRAZING

Land Use Capability

Data concerning resource availability for forestry and grazing uses within the permit area affected by surface operations and facilities were collected and assimilated by Dr. Joseph R. Murdock, professor of Botany and Range Science at Brigham Young University, Provo, Utah (1979). Vegetative plot studies were made in the affected permit area within five general area classifications: the spruce-fir timber type, the aspen timber type, the sagebrush type, the riparian type and the unrecovered disturbed area type, composed of existing roads and the unrecovered site of an abandoned gas well and the abandoned Eccles Mine located on the proposed portal site. From these specific vegetative plot studies, the productivity and capability of supporting grazing and forestry uses were determined for each general area. The plot studies revealed that both the spruce-fir timber type and the unrecovered disturbed area type contained no significant herbage usable for grazing purposes.

The number of animal units and animal unit months that the other three areas are capable of supporting was determined by converting the available green plant species desirable by sheep to a dry weight basis and assuming that one 1,100 pound cow having one calf, which constitutes an animal unit, consumes 27 pounds per day. The results of this analysis are presented in Table 2.12.2-1 for the yard area, the conveyor corridor and the bypass road.

The capability of the area affected by surface operations and facilities to support forestry uses was determined from the total land area in the spruce-fir and aspen timber types and the available timber volume per area as published by the U.S. Forest Service in the "Land and Resource Management Plan" for the Manti-LaSal National Forest, (1986). The spruce-fir timber type contained approximately 10,000 board-feet per acre and the aspen timber type contains 5,300 board-feet per acre. Therefore, within the affected area, there were approximately 201,000 board-feet of the spruce-fir timber and 93,800 board-feet of aspen timber.

Productivity

Sheep currently graze the lease and permit areas in accordance with the sheep allotments as specified in Table 2.12.1-1.

Recreation

Recreational use of the area affected by mine surface operations and facilities is limited primarily to sight seeing, fishing, hunting, snowmobiling and cross country skiing.

Eccles Canyon presently supports and is capable of supporting a self-reproducing population of cutthroat trout from South Fork to the mouth of the canyon. The only time a fishery potential exists above South Fork near the mine portal area is in the springtime when runoff volumes are highest (Winget, 1979).

The newly built highway (SR-264) through Eccles Canyon provides the only access route between recreational facilities in the north end of the Wasatch Plateau and the Scofield Reservoir recreation area. The U.S. Forest Service states that Electric Lake has added a considerable amount of recreational traffic to Eccles Canyon and that 1977 vehicle counts from June to the middle of October were approximately 22,000, which averages 160 vehicles per day. This number is increasing with the completion

TABLE 2.12.2-1

GRAZING POTENTIAL FOR THE AREA TO BE AFFECTED BY MINING SURFACE OPERATIONS AND FACILITIES
(Does not include State Highway SR-264)

Surface Facilities Area	General Area Classification	Land Area (Acres)	Grazing Animal Units (AU)	Potential Animal Unit Month (AUM)
1. Portal Yard Area	Spruce-Fir	16.47	0	0
	Aspen	7.93	114	3.8
	Sagebrush	2.5	84	2.8
	Disturbed	8.5	0	0
	Riparian	1.0	38	1.3
Subtotal		36.4	236	7.9
2. Conveyor Corridor	Aspen	2.2	32	1.1
	Sagebrush	3.98	107	3.6
Subtotal		6.18	139	4.7
3. Railroad Loadout Area	Grass-Forb	10.32	126	4.2
	Spruce-Fir	3.5	0	0.0
Subtotal		13.82	126	4.2
4. Waste Rock Disposal Area	Disturbed	1.67	0	0
Subtotal		1.67	0	0
5. Water Tank and Well Pads	Aspen	.26	18	1
South Fork Breakout	Spruce-Fir	.96	0	0
Subtotal		1.22	18	1
TOTAL		59.29	519	17.8

of the new highway. A stated management requirement of the Forest Service resulting from this vehicle count is to "provide new access connecting the Scofield area with Huntington Canyon" (U.S Forest Service, 1979).

Farming

Referring to agricultural lands within the lease and permit areas for the Skyline mine, T.B. Hutchins, State Soil Scientist for Utah, in a letter addressed to Keith Welch, Environmental Coordinator for the Permittee, made the following written statement, "Field evaluation of the area outlined on your map in Eccles Canyon shows no prime farmland in the area".

Farming in the lease and permit areas would be impractical due to the steep terrain (50 - 80 percent slopes).

PREVIOUSLY MINED AREAS

Underground Mined Areas

The abandoned Eccles Canyon coal mine, located in the southwest quarter of the southwest quarter of section 13 of T13S and R6E, is the only mine located in the proposed mine plan area. The Eccles Canyon mine, operated intermittently from 1899 to 1952, mined the Lower O-Connor "A" seam using the room and pillar method. The mine covered an area of approximately 500 feet south of the portal and 700 feet west of the National Forest boundary (Doelling, 1972 and Heath, 1979). Doelling (1972) states, "Little is known about the Eccles Canyon mine....Production figures are incomplete but estimated to be small." The Eccles Canyon Mine portals have been covered and sealed by SR-264 and the Skyline Mine benches.

No other known minerals of value have been mined within the lease and permit area. There are two producing and two abandoned gas wells located in Eccles Canyon. These gas wells are not classified as "mining". Therefore, no other minerals have been mined within the Skyline coal lease area.

Surface Mined Areas

There have been no previous surface mines located within the mining plan area or adjacent areas. The waste rock disposal area was an abandoned strip mine.

LOCAL LAND USE CLASSIFICATIONS

Both the county zoning ordinances and the "Land and Resource Management Plan" for the Manti-LaSal National Forest, prepared by the U.S. Forest Service (1986), classify local land-use for the lease area of the Skyline Mine as recreation, forestry and mining.

County Zoning Ordinances

The Emery County zoning map dated 1970 and the Carbon County zoning ordinance amended February 15, 1977 with a revised zoning map dated 1974 have zoned the Skyline property for recreation, forestry, and mining (RF&M). Section 8-7-1 of the Carbon County zoning ordinance states:

> "Recreation, forestry, and mining zone has been established as a district in which the primary use of the land is for recreation, forestry, grazing, wildlife, and mining purposes. In general this zone....is characterized by...high grazing lands interspersed by ranches, recreational camps and resource outdoor recreational facilities and mines and facilities related thereto."

U.S. Forest Service Land Management Plan

All but approximately seventy acres of the lease area lie within the boundary of the National Forest, and are therefore subject to the "Land and Resource Management Plan" for the Manti-LaSal

National Forest prepared by the U.S. Forest Service (1986). National Forest System lands within the permit area include the following management units (Management emphasis for each unit is described):

RNG (Range) Management Unit - Emphasis is on production of forage and cover for domestic livestock and wildlife.

TBR (Timber) Management Unit - Emphasis is on management for production and use of wood - fiber for a variety of wood products.

UC (Utility Corridor) Management Unit - Emphasis is on providing transportation corridors for major cross-country pipelines, electrical transmission lines and telephone lines. This unit currently contains a gas transmission pipeline constructed and operated under a Forest Service special-use permit issued to Questar Pipeline Company (main line 41).

RPN (Riparian) Management Unit - Emphasis is on management of riparian areas and all the component ecosystems. The units consist of a zone approximately 100 feet measured horizontally from the edge of all perennial streams and springs, and from the shores of lakes and other still water bodies.

MMA (Minerals Management Area) Management Unit - Emphasis is on making land surface available for existing and potential major mineral developments.

In the "Land and Resource Management Plan" the Forest Service lists specific objectives pertaining to management of resources and resource uses on National Forest System lands. The Forest Service portion of the disturbed area (portal area) is currently identified as a Minerals Management (MMA) Unit. After completion of coal mining activity, the area will revert to a Range (RNG) Management unit.

COMPATIBILITY OF MINING OPERATION WITH FOREST SERVICE MANAGEMENT EMPHASIS AND OBJECTIVES

All mining activities related to the Forest Service "Land and Resource Management Plan" will be coordinated with the appropriate Forest Service personnel prior to implementation. While it is recognized that the fact that the mine located as it is on the Forest Service land boundary creates impacts, primarily visual and traffic pattern related, these effects are considered to be rather short term and will be essentially eliminated upon mine closure.

ARCHAEOLOGY AND PALEONTOLOGY IMPACTS

State and Federal laws require protection of certain cultural resources. The mining operation is considered compatible with the requirements of all agencies in this area, since to date, there are no known archaeological or paleontological sites within the proposed disturbed areas. Section 2.1.1 and Appendix Volume A-3 contain additional discussion and documentation on these cultural resources.

BUILDINGS, PUBLIC ROADS, AND OTHER MAN-MADE FACILITIES

There are few man-made features located within the Skyline Mine permit area. One abandoned gas well is located within the permit area in Eccles Canyon. The only building located within the permit area is a small structure associated with Gas Well No.8. A natural gas pipeline traverses the permit area and an associated gas tank is located east of the southeastern boundary of the lease area. The location of public roads, including SR-264, within and adjacent to the lease area are illustrated in Map 2.12.1-1. A USGS gauging station was located near the mouth of Eccles Canyon but was removed during the summer of 1985. (See also the reclamation discussion in Part 4.)

CEMETERIES, NATIONAL TRAILS AND WILD RIVERS

There are no cemeteries, national trails, or wild rivers located within or adjacent to the Skyline Mine lease and permit areas.

REFERENCES

Christensen, Reed C., Forest Supervisor, Robert W. Thompson, Range Conservationist, U.S. Forest Service, Manti-LaSal National Forest, Price, Utah, in a personal communication in March, 1979.

Daniels, Ronald W., Coordinator of Mine Land Development, Division of Oil, Gas, and Mining, Salt Lake City, Utah, in a personal communication in August, 1979.

U.S. Geological Survey, 1979, Development of Coal Resources in Central Utah Final Environmental Statement Site Specific Analysis - Part 2. Salt Lake City, Utah.

Doelling, H.H., 1972, Wasatch Plateau Coal Field. In Doelling, H.H. (ed.). Central Utah Coal Fields; Sevier-Sanpete, Wasatch Plateau, Book Cliffs and Emery. Utah Geological and Mineralogical Survey Monograph Series No. 3. Salt Lake City, Utah.

Foster, Lee, Forest Management Planner, U.S. Forest Service, Manti-LaSal National Forest, Price, Utah, in a personal communication in August, 1979.

Heath, Roland, Manager of Engineering, Coastal States Energy Company, Houston, Texas, in a personal communication in August, 1979.

Murdoch, Joseph R., Professor of Botany and Range Science, Brigham Young University, Provo, Utah, in a personal communication in September, 1979.

Office of Surface Mining Reclamation and Enforcement, March 13, 1979, Surface Coal Mining and Reclamation Operations Permanent Regulatory Program, Part II, Book 3 of 3. Federal Register, Volume 44, Number 50.

U.S. Forest Service, Intermountain Region, 1979, Land Management Plan, Ferron-Price Planning Unit, Manti-LaSal National Forest, Price, Utah.

Winget, Robert Newell, Assistant Professor of Zoology and Research Associate for the Center of Health and Environmental Studies, Brigham Young University, Provo, Utah, in a personal communication in August, 1979.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SPECIAL USE PERMIT
QUESTAR PIPELINE COMPANY (MOUNTAIN FUEL SUPPLY)

United States Department of Agriculture
Forest Service

SPECIAL USE PERMIT

Act of June 4, 1897, or February 15, 1901
This permit is revocable and nontransferable

NAME OF PERMITTEE	KIND OF USE
Mountain Fuel Supply Company and Utah Natural Gas Company	Pipeline
DATE OF PERMIT	**FILE CODE**
September 24, 1962	2710

REGION	STATE	FOREST	RANGER DISTRICT
4	Utah	Manti-LaSal	Ephraim, Castle Dale and Mt. Pleasant

Permission is hereby granted to Mountain Fuel Supply Company and Utah Natural Gas Company

of ~~108~~ 180 East First South Street, Salt Lake City, Utah,

hereinafter called the permittee, to use subject to the conditions set out below, the following described lands or improvements:

A main pipeline right-of-way 60 feet wide, 30 feet on each side of centerline, extending 14.363 miles across Sections 6, 8, 9, 14, 15, 16, 23, 24, and 25, T. 12 S., R. 5 E.; Sections 31, 33, T. 12 S., R. 6 E.; and Sections 4, 9, 10, 14, 15, 23, 25, and 26, T. 13 S., R. 6 E.; and a lateral pipeline right-of-way 30 feet wide, 15 feet on each side of centerline, extending 28.845 miles across Sections 24, 25, and 36, T. 13 S., R. 6 E.; Sections 7, 8, 17, 18, 19, 29, 30, 31, and 32, T. 14 S., R. 7 E.; Sections 1, 23, 24, 27, and 34, T. 14 S., R. 6 E.; Sections 5 and 6, T. 15 S., R. 7 E.; Sections 3, 17, 20, 21, 28, and 33, T. 15 S., R. 6 E.; and Sections 4, 9, 10, 15, 22, 23, 26, and 27, T. 16 S., R. 6 E.; all in the Salt Lake Meridian, more specifically shown on plat designated "Rights-of-Way Within Manti-LaSal National Forest Boundary" which is attached and made a part of this permit.

This permit covers ______ acres and/or 43.208 miles and is issued for the purpose of:

Operating and maintaining a natural gas pipeline and related facilities including a patrol road, telephone line, pipe racks and slush pits.

The exercise of any of the privileges granted hereby constitutes acceptance of all the conditions of this permit.

1. In consideration for this use, the permittee shall pay to the Forest Service, U.S. Department of Agriculture, the sum of Three hundred and fifty-two Dollars ($ 352.00) for the period from January 1 19 63, to December 31, 19 63, and thereafter annually on January 1, Three hundred and fifty-two Dollars ($ 352.00): *Provided, however,* Charges for this use may be made or readjusted whenever necessary to place the charges on a basis commensurate with the value of use authorized by this permit.

2700-4 (Rev. 2-60)

2. Construction or occupanc- d use under this permit shall begin w- already constructed months, and construction, if any, shall be com within - months, fr he date of the permit. This use shall be actually exercised at least 365 days each year, unless otherwise authorized in writing.

3. Development plans; layout plans; construction, reconstruction, or alteration of improvements; or revision of layout or construction plans for this area must be approved in advance and in writing by the forest supervisor. Trees or shrubbery on the permitted area may be removed or destroyed only after the forest officer in charge has approved, and has marked or otherwise designated that which may be removed or destroyed. Timber cut or destroyed will be paid for by the permittee as follows: Merchantable timber at appraised value; young-growth timber below merchantable size at current damage appraisal value; *provided* that the Forest Service reserves the right to dispose of the merchantable timber to others than the permittee at no stumpage cost to the permittee. Trees, shrubs, and other plants may be planted in such manner and in such places about the premises as may be approved by the forest officer in charge.

4. The permittee shall maintain the improvements and premises to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the forest officer in charge.

5. This permit is subject to all valid claims.

6. The permittee, in exercising the privileges granted by this permit, shall comply with the regulations of the Department of Agriculture and all Federal, State, county, and municipal laws, ordinances, or regulations which are applicable to the area or operations covered by this permit.

7. The permittee shall take all reasonable precautions to prevent and suppress forest fires. No material shall be disposed of by burning in open fires during the closed season established by law or regulation without a written permit from the forest officer in charge or his authorized agent.

8. The permittee shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this permit, and shall pay the United States for any damage resulting from negligence or from the violation of the terms of this permit or of any law or regulation applicable to the national forests by the permittee, or by any agents or employees of the permittee acting within the scope of their agency or employment.

9. The permittee shall fully repair all damage, other than ordinary wear and tear, to national forest roads and trails caused by the permittee in the exercise of the privilege granted by this permit.

10. No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement or to any benefit that may arise herefrom unless it is made with a corporation for its general benefit.

11. Upon abandonment, termination, revocation, or cancellation of this permit, the permittee shall remove within a reasonable time all structures and improvements except those owned by the United States, and shall restore the site, unless otherwise agreed upon in writing or in this permit. If the permittee fails to remove all such structures or improvements within a reasonable period, they shall become the property of the United States, but that will not relieve the permittee of liability for the cost of their removal and restoration of the site.

12. This permit is not transferable. If the permittee through voluntary sale or transfer, or through enforcement of contract, foreclosure, tax sale, or other valid legal proceeding shall cease to be the owner of the physical improvements other than those owned by the United States situated on the land described in this permit and is unable to furnish adequate proof of ability to redeem or otherwise reestablish title to said improvements, this permit shall be subject to cancellation. But if the person to whom title to said improvements shall have been transferred in either manner above provided is qualified as a permittee and is willing that his future occupancy of the premises shall be subject to such new conditions and stipulations as existing or prospective circumstances may warrant, his continued occupancy of the premises may be authorized by permit to him if, in the opinion of the issuing officer or his successor, issuance of a permit is desirable and in the public interest.

13. In case of change of address, the permittee shall immediately notify the forest supervisor.

14. The temporary use and occupancy of the premises and improvements herein described may be sublet by the permittee to third parties only with the prior written approval of the forest supervisor but the permittee shall continue to be responsible for compliance with all conditions of this permit by persons to whom such premises may be sublet.

15. This permit may be terminated upon breach of any of the conditions herein or at the discretion of the regional forester or the Chief, Forest Service.

16. In the event of any conflict between any of the preceding printed clauses or any provision thereof and any of the following clauses or any provisions thereof, the preceding printed clauses will control.

17. This permit is accepted subject to the conditions set forth above and to conditions 18 to 29 attached hereto and made a part of this permit.

~~DATE~~	~~SIGNATURE OF ISSUING OFFICER~~	~~TITLE~~

18. The permittee agrees to allow officers and employees of the United States free and unrestricted access in, through and across the said project and project works in the performance of their official duties, and also agrees to allow the Forest Service, without charge, to construct or permit to be constructed in, through and across the said project, railroads, chutes, roads, trails, conduits, and other means of transportation not inconsistent with the enjoyment of said project by the permittee for the purpose herein set forth.

19. The permittee agrees to permit free and unrestricted access and use by the public to and upon the premises at all times for all lawful and proper purposes not inconsistent with the objects of the permit or with the reasonable exercise and enjoyment by the permittee of the privileges thereof.

20. The permittee stipulates, agrees and consents that the granting of this right-of-way shall be subject to the express condition that the exercise thereof will not interfere in any way with the leasing and administration by the United States of the lands affected thereby, or with the development of oil, gas, potassium and sodium therefrom; and that the applicant agrees and consents to the use of such portion of the right-of-way not actually occupied by the pipeline for and in connection with drilling or mining operations for the development and production of oil, gas, potassium and sodium and the operations of wells thereon.

21. The permittee agrees that all forms of encroachment on running streams will be avoided and under no circumstances shall waste materials be deposited in or permitted to obstruct perennial stream channels.

22. The permittee shall construct and maintain approved cattle guards and by-pass gates in all the Government fences cut, as required by the Forest Supervisor.

23. The permittee agrees to obtain permission from the Forest Service before removing any timber or opening any borrow pit.

24. The scenic and aesthetic values of the right-of-way and the adjacent land shall be protected as far as possible consistent with the authorized use, during construction, operation and maintenance of the pipeline.

25. The permittee agrees to be responsible for prevention and control of soil erosion and gullying on lands covered by this permit and adjacent thereto resulting from the permittee's construction or maintenance. Such preventive measures may include vegetating with grass or herbaceous plants all ground cover where the soil has been exposed, and construction and maintenance of such preventive works as may be prescribed by the Forest Service.

26. This permit confers no rights upon the permittee to use this right-of-way for purposes other than for maintaing and operating a pipeline.

27. To guarantee the fulfillment of the conditions of this permit, the permittee will furnish the Forest Service a bond in the amount of ten thousand dollars ($10,000) prior to undertaking any work on the permit area. The bond

may be a surety bond by an approved corporate surety or a cash deposit. When, in the opinion of the Forest Service, the bond is no longer needed to assure fulfillment of the conditions of this permit or the settlement of claims incident thereto, surety will be notified or deposits in lieu of bond will be returned to the permittee without interest subject to the conditions set forth in the next sentence. The permittee agrees that all moneys deposited in lieu of bond under this permit may, upon failure on his part to fulfill all and singular the requirements herein set forth or made a part hereof, be retained by the United States to be applied as far as may be to the satisfaction of his obligations assumed hereunder, without prejudice whatsoever to any other rights and remedies of the United States.

28. This permit supersedes the special use permit issued to Utah Natural Gas Company on March 3, 1953 as amended.

29. This permit shall have no force and effect until the permittee has signified acceptance of its provisions and conditions by signing below and returning the duplicate copy to the Forest Supervisor.

ADRIAN E. DALTON
Forest Supervisor

September 24, 1962
Date

By David M. Moon

We have read the foregoing permit and agree to accept and abide by its terms and conditions.

October 16, 1962
Date

MOUNTAIN FUEL SUPPLY COMPANY

/s/ J.H. Simon
By

Vice President
Title

United States Department of Agriculture
Forest Service

SPECIAL USE PERMIT

~~Act of June 4, 1897~~
~~This permit is revocable and nontransferable~~
(Ref. FSM 2710)
Section 28 of the Mineral Leasing Act of 2/25/20 as amended 11/16/73 (P.L. 93-153)

a. Record no. (1-2)	b. Region (3-4)	c. Forest (5-6)
70	04	10
d. District (7-8)	e. User number (9-12)	f. Kind of use (13-15)
03	4095	811
g. State (16-17)	h. County (18-20)	k. Card no. (21)
49	007	1

Permission is hereby granted to Mountain Fuel Resources Inc.

of P.O. Box 11450, Salt Lake City, Utah 84147

hereinafter called the permittee, to use subject to the conditions set out below, the following described lands or improvements: A main pipeline right-of-way 60 feet wide, 30 ft. on each side of centerline, extending 14.363 miles across Section 6, 8, 9, 14, 15, 16, 23, 24 and 25, T12S., R5E.; Sections 31, 33, T12S., R6E: and Sections 4, 9, 10, 14, 15, 23, 25, and 26, T13S., R6E.; and a lateral pipeline right-of-way 30 ft. wide, 15 ft. on each side of centerline, extending 28.845 miles across Sections 24, 25, and 36, T13S., R6E.; Sections 7, 8, 17, 18, 19, 29, 30, 31, and 32, T14S., R7E.; Sections 1, 23, 24, 27, and 34, T14S., R6E.; Sections 5 and 6 T15S., R7E.; Sections 3, 17, 20, 21, 28, and 33, T15S., R6E.; and Sections 4, 9, 10, 15, 22, 23, 26, 27, and 35, T16S., R6E., more specifically shown on plat on file in the Supervisor's Office, Manti-LaSal National Forest.

This permit covers 215.71 acres and/or 44.958 miles and is issued for the purpose of: Operating and maintaining a natural gas pipeline and related facilities including a patrol road, telephone line, pipe racks and slush pits.

1. Construction or occupancy and use under this permit shall begin within 1 months, and construction, if any, shall be completed within 6 months, from the date of the permit. This use shall be actually exercised at least 365 days each year, unless otherwise authorized in writing.

2. In consideration for this use, the permittee shall pay to the Forest Service, U.S. Department of Agriculture, the sum of Four Hundred Fifty Dollars ($ 450.00) for the period from January 1 1984, to December 31, 1984, and thereafter annually on January 1, Four Hundred Fifty Dollars ($ 450.00): *Provided, however,* Charges for this use may be made or readjusted whenever necessary to place the charges on a basis commensurate with the value of use authorized by this permit.

3. This permit is accepted subject to the conditions set forth herein, and to conditions 18 to 37 attached hereto and made a part of this permit.

	NAME OF PERMITTEE	SIGNATURE OF AUTHORIZED OFFICER	DATE
PERMITTEE	MOUNTAIN FUEL RESOURCES INC.	TITLE Vice Chairman of the Board	7/31/84
	NAME AND SIGNATURE	TITLE	DATE
ISSUING OFFICER	Ross E Butler	Acting Forest Supervisor	8/3/84

(CONTINUED ON REVERSE)

4. Development plans; layout plans, construction, reconstruction, or alteration of improvements; or revision of layout or construction plans for this area must be approved in advance and in writing by the forest supervisor. Trees or shrubbery on the permitted area may be removed or destroyed only after the forest officer in charge has approved, and has marked or otherwise designated that which may be removed or destroyed. Timber cut or destroyed will be paid for by the permittee as follows: Merchantable timber at appraised value; young-growth timber below merchantable size at current damage appraisal value; *provided* that the Forest Service reserves the right to dispose of the merchantable timber to others than the permittee at no stumpage cost to the permittee. Trees, shrubs, and other plants may be planted in such manner and in such places about the premises as may be approved by the forest officer in charge.

5. The permittee shall maintain the improvements and premises to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the forest officer in charge.

6. This permit is subject to all valid claims.

7. The permittee, in exercising the privileges granted by this permit, shall comply with the regulations of the Department of Agriculture and all Federal, State, county, and municipal laws, ordinances, or regulations which are applicable to the area or operations covered by this permit.

8. The permittee shall take all reasonable precautions to prevent and suppress forest fires. No material shall be disposed of by burning in open fires during the closed season established by law or regulation without a written permit from the forest officer in charge or his authorized agent.

9. ~~The permittee shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this permit, and shall pay the United States for any damage resulting from negligence or from the violation of the terms of this permit or of any law or regulation applicable to the National Forests by the permittee, or by any agents or employees of the permittee acting within the scope of their agency or employment.~~

10. The permittee shall fully repair all damage, other than ordinary wear and tear, to national forest roads and trails caused by the permittee in the exercise of the privilege granted by this permit.

11. No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement or to any benefit that may arise herefrom unless it is made with a corporation for its general benefit.

12. Upon abandonment, termination, revocation, or cancellation of this permit, the permittee shall remove within a reasonable time all structures and improvements except those owned by the United States, and shall restore the site, unless otherwise agreed upon in writing or in this permit. If the permittee fails to remove all such structures or improvements within a reasonable period, they shall become the property of the United States, but that will not relieve the permittee of liability for the cost of their removal and restoration of the site.

13. This permit is not transferable. If the permittee through voluntary sale or transfer, or through enforcement of contract, foreclosure, tax sale, or other valid legal proceeding shall cease to be the owner of the physical improvements other than those owned by the United States situated on the land described in this permit and is unable to furnish adequate proof of ability to redeem or otherwise reestablish title to said improvements, this permit shall be subject to cancellation. But if the person to whom title to said improvements shall have been transferred in either manner provided is qualified as a permittee and is willing that his future occupancy of the premises shall be subject to such new conditions and stipulations as existing or prospective circumstances may warrant, his continued occupancy of the premises may be authorized by permit to him if, in the opinion of the issuing officer or his successor, issuance of a permit is desirable and in the public interest.

14. In case of change of address, the permittee shall immediately notify the forest supervisor.

15. The temporary use and occupancy of the premises and improvements herein described may be sublet by the permittee to third parties only with the prior written approval of the forest supervisor but the permittee shall continue to be responsible for compliance with all conditions of this permit by persons to whom such premises may be sublet.

16. This ~~permit may be terminated upon breach of any of the conditions herein or at the discretion of the regional forester or the Chief, Forest Service.~~

17. In the event of any conflict between any of the preceding printed clauses or any provisions thereof and any of the following clauses or any provisions thereof, the following clauses will control.

914-073

18. In addition to the annual land rental fees specified in clause 2 above, the permittee shall, upon demand, pay to the United States such sums as the Forest Service shall determine to be required to reimburse the United States for all administrative and other costs incurred directly or indirectly by the United States in processing each application, including environmental studies, and in monitoring and construction, operation, maintenance, and termination of the pipeline or related facility, or portions thereof.

Additional extraordinary costs of monitoring such activities as construction, reconstruction, relocation, restoration, and rehabilitation of environmental damage caused by the permittee's activities or by presence of the pipeline or related facility shall be determined by the Forest Service on the basis of actual expenditure and will be paid by permittee upon demand.

This clause covers reimbursement of administrative costs, as required by Public Law 93-153, and does not cover damages to property of the United States which are covered elsewhere in this permit.

19. A late payment charge in addition to the regular fees shall be made for failure to meet the fee payment due date or any of the dates specified for submission of statements required for fee calculation. The late payment charge shall be $20, or an amount calculated by applying the current rate prescribed by Treasury Fiscal Requirements Manual Bulletins to the overdue amount for each 30-day period or fraction thereof that the payment is overdue, whichever is greater. If the due dates falls on a nonworkday, the late payment charge will not apply until the end of the next workday. This permit may be terminated for nonpayment of fees and/or assessed late payment charges.

20. The width of the right-of-way is limited to 16 feet plus the ground occupied by the pipe.

21. Permittee shall take all measures necessary to protect the health and safety of all persons affected by its activities performed in connection with the construction, operation, maintenance, or termination of the right-of-way, and shall promptly abate as completely as possible any physical or mechanical procedure, activity, event, or condition, existing or occurring at any time: (1) that is susceptible to abatement by the permittee, (2) which arises out of, or could affect adversely, the construction, operation, maintenance, or termination of all or any part of the pipeline, and (3) that causes or threatens to cause: (a) a hazard to the safety of workers or to public health or safety, or (b) serious and irreparable harm or damage to the environment (including but not limited to areas of vegetation or timber, fish or other wildlife populations, or their habitats, or any other natural resource). Permittee shall immdeiately notify the District Ranger of all serious accidents which occur in connection with such activities.

22. Permittee shall use care not to damage any fish, wildlife, or biotic resources in the general area of the right-of-way upon which persons living in the area rely for subsistence purposes and will promptly comply with all requirements and orders of the District Ranger to protect the interests of such persons.

23. All design, materials and construction, operation, maintenance, and termination practices employed in connection with the pipeline shall be in accordance with safe and proven engineering practice and shall meet or exceed the following standards:

    (1) ASME Gas Piping Standards Committee, "Guide for Gas Transmission and Distribution Piping System" (3rd Edition, April 1976).

    (2) Department of Transportation and Regulations, 49 CFR, Part 192, "Transportation of Natural and other Gas by Pipelines: Minimum Federal Safety Standards."

24. Permittee shall conduct all activities associated with the pipeline in a manner that will avoid or minimize degradation of air, land, and water quality. In the construction, operation, maintenance, and termination of the pipeline, permittee shall perform its activities in accordance with applicable air and water quality standards, related facility siting standards, and related plans of implementation, including but not limited to standards adopted pursuant to the Clean Air Act, as amended (42 U.S.C. 1857) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1321).

25. Permittee shall be responsible for prevention and control of soil erosion and gullying on lands covered by this permit and adjacent thereto, resulting from construction, operation, maintenance, and termination of the permitted use. Permittee shall so construct permitted improvements to avoid the accumulation of excessive heads of water and to avoid encroachment on streams. Permittee shall revegetate or otherwise stabilize all ground where the soil has been exposed and shall construct and maintain necessary preventive measures to supplement the vegetation.

26. The permittee shall protect the scenic-esthetic values of the area under this permit, and the adjacent land, as far as possible with the authorized use, during construction, operation, and maintenance of the improvements.

27. Unless sooner terminated or revoked by the Regional Forester, in accordance with the provisions of the permit, this permit shall expire and become void on December 31, 2005 but a new permit to occupy and use the same National Forest land may be granted provided the permittee will comply with the then-existing laws and regulations governing the occupancy and use of National Forest System lands and shall have notified the Forest Supervisor not less than 1 year prior to said date that such new permit is desired.

28. This permit shall not be exclusive. The Forest Service reserves the right to use or permit others to use any part of the permitted area for compatible purposes.

29. This permit is granted with the express understanding that should future location of Government owned improvements require the relocation of the permittee's improvements, such relocation will be done by, and at, the permittee's expense within a reasonable time as specified by the Authorized Officer.

30. Pipelines and related facilities authorized herein, shall be constructed, operated, and maintained as common carriers. The permittee shall accept, convey, transport, or purchase without discrimination all oil or gas delivered to the pipeline without regard to whether such oil or gas was produced on Federal or non-Federal lands.

In the case of oil or gas produced from Federal lands or from the resources on the Federal lands in the vicinity of the pipeline, the Secretary of the Interior may, after a full hearing with due notice thereof to the interested parties and a proper finding of facts, determine the proportionate amounts to be accepted, conveyed, transported, or purchased. Provided, that this stipulation shall not apply to any natural gas pipeline operated by any person subject to regulation under the Natural Gas Act or by any public utility subject to regulation by a State or municipal regulatory agency having jurisdiction to regulate the rates and charges for the sale of natural gas to consumers within the State of municipality. Where natural gas not subject to State regulatory or conservation laws governing its purchase by pipelines is offered for sale, each such pipeline shall purchase, without discrimination, any such natural gas produced in the vicinity of the pipeline.

31. Abandonment of the right-of-way or noncompliance with any provision of Section 28 of the Mineral Leasing Act, as amended, or terms and conditions of this permit may be grounds for suspension or termination of the permit: if (A) after due notice to the holder of the right-of-way, (B) a reasonable opportunity to comply, and (C) an appropriate administrative proceeding pursuant to Title V, United States Code, Section 554, the Authorized Officer determines that any such grounds exist and that suspension or termination is justified.

If the Authorized Officer determines that an immediate temporary suspension of activities within the right-of-way or permit area is necessary to protect public health or safety or the environment, such activities may be curtailed prior to an administrative proceeding.

Deliberate failure of the permittee to use the right-of-way for the purpose for which it is granted or renewed, for any continuous 2-year period, shall constitute a rebuttable presumption of abandonment of the right-of-way.

32. The permittee shall take reasonable precautions to protect, in place, all public land survey monuments, private property corners, and Forest boundary markers. In the event that any such land markers or monuments are destroyed in the exercise of the privileges authorized by this permit, depending on the type of monument destroyed, the permittee shall see that they are reestablished or reference in accordance with (1) the procedures outlined in the "Manual of Instruction for the Survey of the Public Land of the United States," (2) the specifications of the county surveyor, or (3) the specifications of the Forest Service.

Further, the permittee shall cause such official survey records as are affected to be amended as provided by law.

33. The permittee shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of National Forest lands under this permit.

34. The permittee shall be held liable for all injury, loss, or damage including fire suppression costs, directly or indirectly resulting from or caused by the permittee's use and occupancy of the area covered by the permit, regardless of whether the permittee is negligent or otherwise at fault, provided that the maximum liability without fault shall not exceed $1 million for any one occurrence and provided further that the permittee shall not be liable when such injury, loss, or damage results wholly, or in part, from a negligent act of the United States, or an act of a third party not involving the facilities of the permittee.

Liability for injury, loss, or damage, including fire suppression costs, in excess of the specified maximum, shall be determed by the laws governing ordinary negligence.

35. If, prior to or during excavation work, items of archeological or paleontological value are reported or discovered, or a unknown deposit of such items is disturbed, the permittee will immediately cease excavation in the area so affected. Permittee will then notify the Forest Service and will not resume excavation until written approval is given by the Authorized Officer.

36. Pesticides may not be used to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, trash fish, etc., without the prior written approval of the Forest Service. A request for approval of planned uses of pesticides will be submitted annually by the permittee on the due date established by the Forest Supervisor. The report will cover a 12 month period of planned use beginning 3 months after the reporting date. Information essential for review will be provided in the form specified. Exceptions to this schedule may be allowed, subject to emergency request and approval, only when unexpected out breaks of pests require control measures which were not anticipated at the time an annual report was submitted.

Only those materials registered by the U.S. Environmental Protection Agency for the specific purpose planned will be considered for use on National Forest System lands. Label instructions will be strictly followed in the application of pesticides and disposal of excess materials and containers.

37. The permittee does by the acceptance of this document covenant and agree for itself, its assigns, and its successors in interest to the property here, permitted or any part thereof, that the covenant set forth below shall attach to and run with the land:

a. The described property and its appurtenant areas and its building and facilities whether or not on the land therein permitted will be operated as a gas line in full compliance with Title VI of the Civil Rights Act of 1964 and all requirements imposed by or pursuant to the regulations issued thereunder by the Department of Agriculture and in effect on the date of this document to the end that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied and benefits of, or be subjected to discrimination under any programs or activities provided thereon; and

b. The United States shall have the rights to judicial enforcement of these covenants not only as to the permittee, its successors and assigns, but also as to lessees and licensees doing business or extending services under contractual or other arrangements on the land herein coveyed. In the event of a breach of any of the conditions set forth above, all right, title, and interest in and to the above described property shall, at the option of the Grantor, revert to and become the property of the United States of America, which shall have an immediate right of entry thereon, and the permittee, its successors or assign, shall forfeit all right, title, and interest in and to the above described property and in any and all of the tenements, hereditaments and appurtenances thereunto belonging; provided, however, that the failure of the Grantor to assist in any one or more instances upon complete performance of any of the said conditions shall not be construed as a waiver or a relinquishment of the future performance of any such conditions, but the obligations of the permittee with respect so future performance shall continue in full force and effect.

QUESTAR PIPELINE COMPANY

79 SOUTH STATE STREET • P. O. BOX 11450 • SALT LAKE CITY, UTAH 84147 • PHONE (801) 530-2511

TIMOTHY R. BLACKHAM
DIRECTOR PROPERTY AND
RIGHTS OF WAY DEPARTMENT

MANTI-LASAL N.F.
MAY 31 1988
FS
Walt
Lina
Charlene
Bessie

May 25, 1988

Forest Supervisor
U. S. Department of Agriculture
Forest Service
Manti-LaSal Forest
599 West Price River Drive
Price, Utah 84501

D-1
CC: D-2
~~D-3~~

Dear Sir:

Effective March 7, 1988, Mountain Fuel Resources, Inc. changed its name to Questar Pipeline Company. Our mailing address will remain the same:

79 South State Street
P.O. Box 11450
Salt Lake City, Utah 84147

It is our request that any rights of way in your Forest Service area be updated to reflect the new name.

Please let us know if you have any questions regarding this matter.

Very truly yours,

Timothy R Blackham

FOREST SERVICE
MANTI-LASAL NATIONAL FOREST
PRICE RANGER DISTRICT
JUL 11 1988

ACTION	TO	INFO.
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QUESTAR PIPELINE COMPANY

79 SOUTH STATE STREET • P. O. BOX 11450 • SALT LAKE CITY, UTAH 84147 • PHONE (801) 530-2511

TIMOTHY R. BLACKHAM
DIRECTOR PROPERTY AND
RIGHTS OF WAY DEPARTMENT

May 25, 1988

Forest Supervisor
U. S. Department of Agriculture
Forest Service
Manti-LaSal Forest
599 West Price River Drive
Price, Utah 84501

D-1
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Timothy R Blackham

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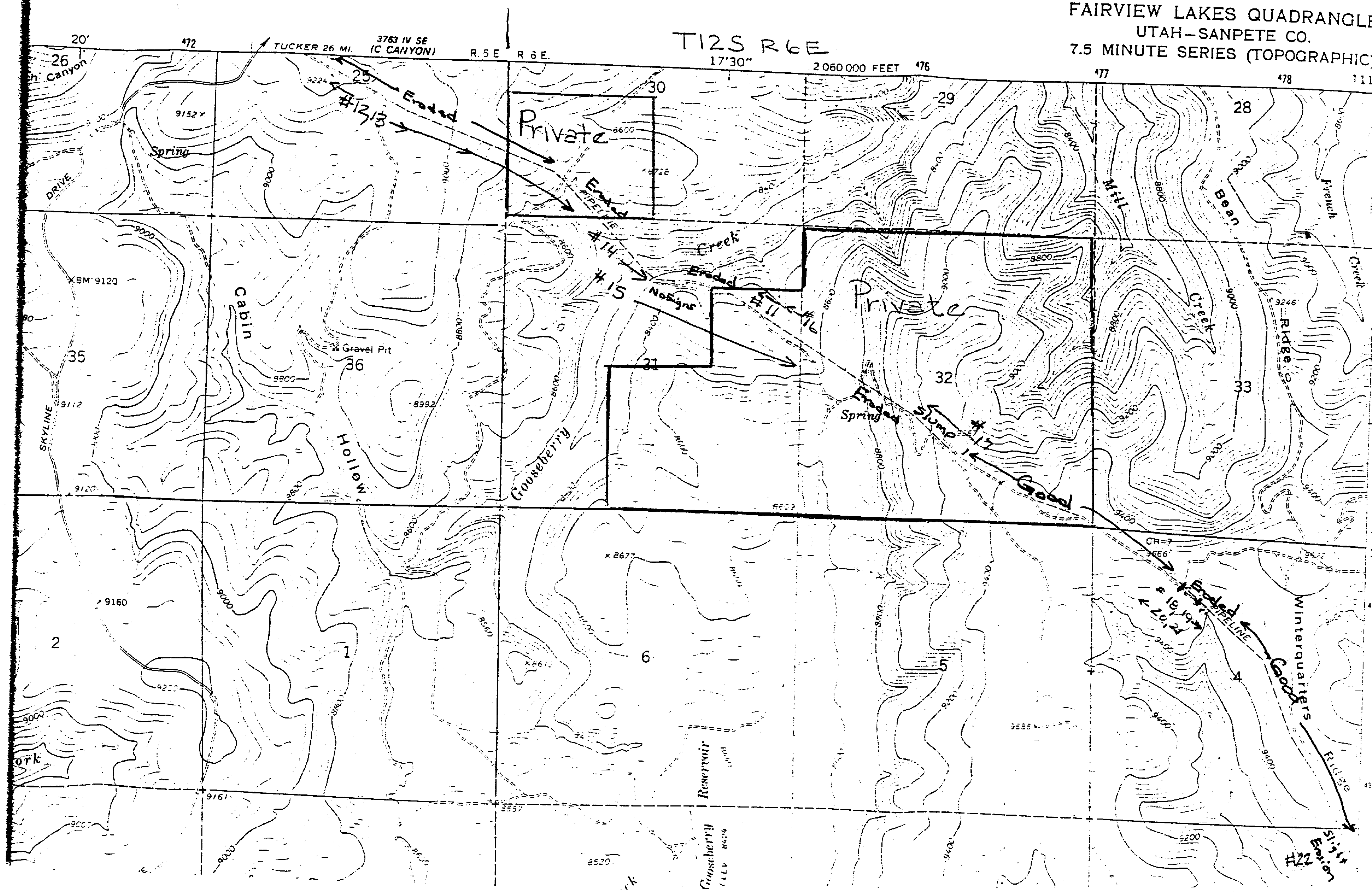
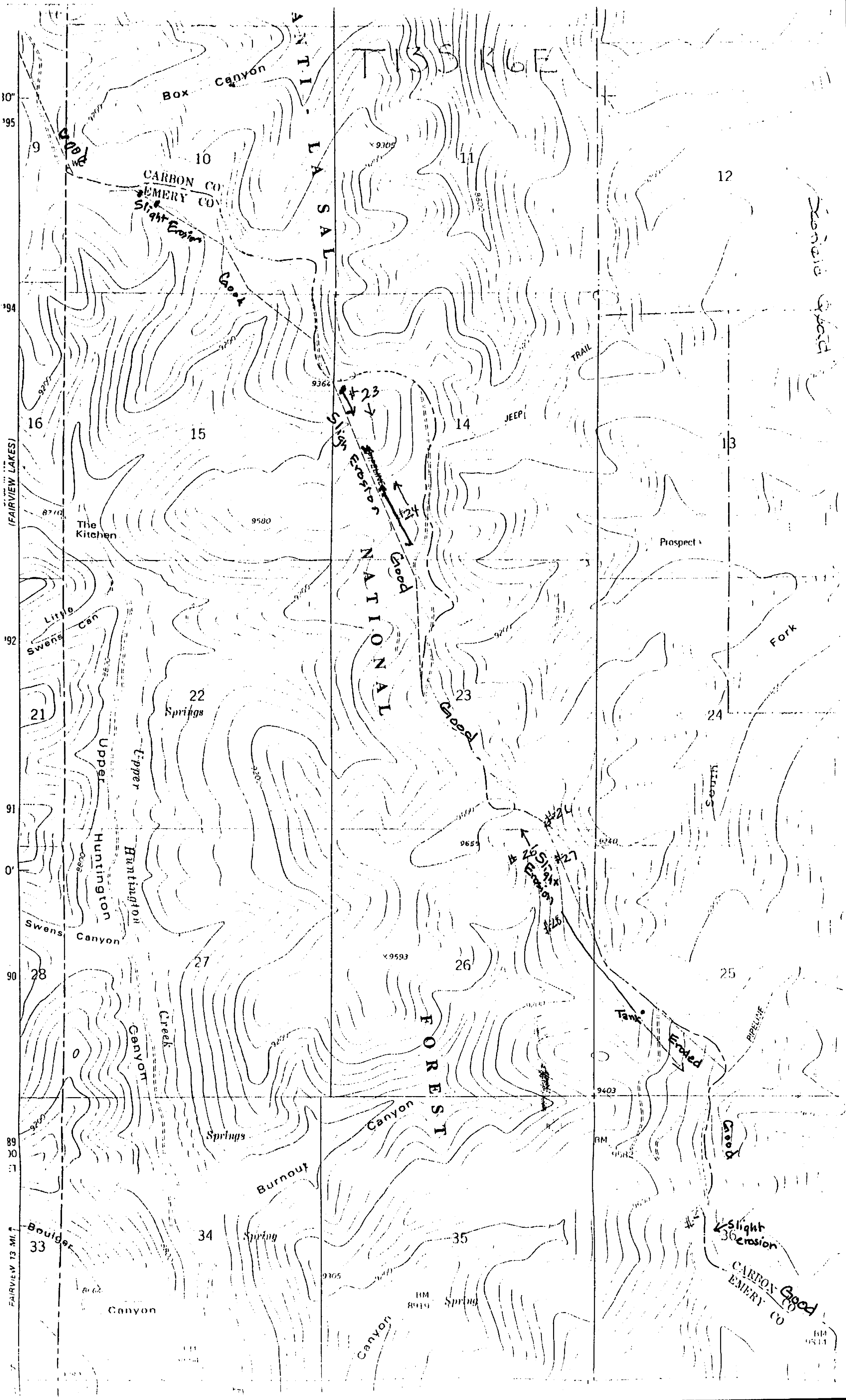
FAIRVIEW LAKES QUADRANGLE
UTAH–SANPETE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)





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Box Canyon
MANTI - LA SAL NATIONAL FOREST
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EMERY CO
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Slight Erosion
Good
#23
#24
Slight Erosion
Good
Good
JEEP TRAIL
The Kitchen
Little Swens Can
Prospect
Fork
South
Springs
Upper Huntington
Upper Huntington
Swens Canyon
Huntington Creek Canyon
#24
#26
#27
#28
Slight Erosion
Tank
Eroded
Good
Springs
Canyon
Burnout
Boulder Canyon
Spring
Spring
Canyon
Slight erosion
CARBON CO
EMERY CO
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(FAIRVIEW LAKES)
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SOIL AND LAND USE INVENTORIES SCHOFIELD PROJECT
UCO, INC.
1982

GROUND COAL MINING PERMIT APPLICATION

SCOFIELD MINE

CARBON COUNTY, UTAH

UCO, Inc.
7355 E. Orchard Rd.
Suite 100
Englewood, Colorado 80111

September, 1982

James P. Walsh & Associates, Inc.
Surficial Geology/Soils/Land Use

SOIL AND LAND USE INVENTORIES

SCOFIELD PROJECT: UCO, INC.

CARBON COUNTY, UTAH

June 1981

Updated July 30, 1982

Prepared for:

J. Chris Carter
Vice President, Governmental Affairs
UCO, Inc.
7355 E. Orchard Road, Suite 100
Englewood, Colorado 80111

Prepared by:

James P. Walsh

Certified Professional Soil Scientist
ARCPACS #2002

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1.0 INTRODUCTION

1.1 PURPOSE

Soil and land-use inventories were made of UCO, Inc.'s proposed underground coal mine, the Scofield Mine. The soil inventory was conducted to provide soil resource information to meet the requirement of the Utah Division of Oil, Gas and Mining regarding surface effects of underground coal mining activities as set forth in the Utah Mining and Reclamation Permanent Program, Chapter I, Subchapter A, Part UMC 783.21. The land-use inventory was conducted to meet Part UMC 783.22 of the same regulatory program.

The mine and its facilities are to be located near the Town of Scofield in the Wasatch Plateau in central Utah. Scofield is located in Pleasant Valley (Figure 1), a grassy valley surrounded on the east, south, and west by hills. To the north of Scofield is Scofield Reservoir. The hills have a total relief of about 1500 to 1700 feet. The hills are generally forested on their north sides while the south sides are covered with grass and shrubs. The climate varies from subhumid on the north-facing slopes to semiarid on the south-facing slopes.

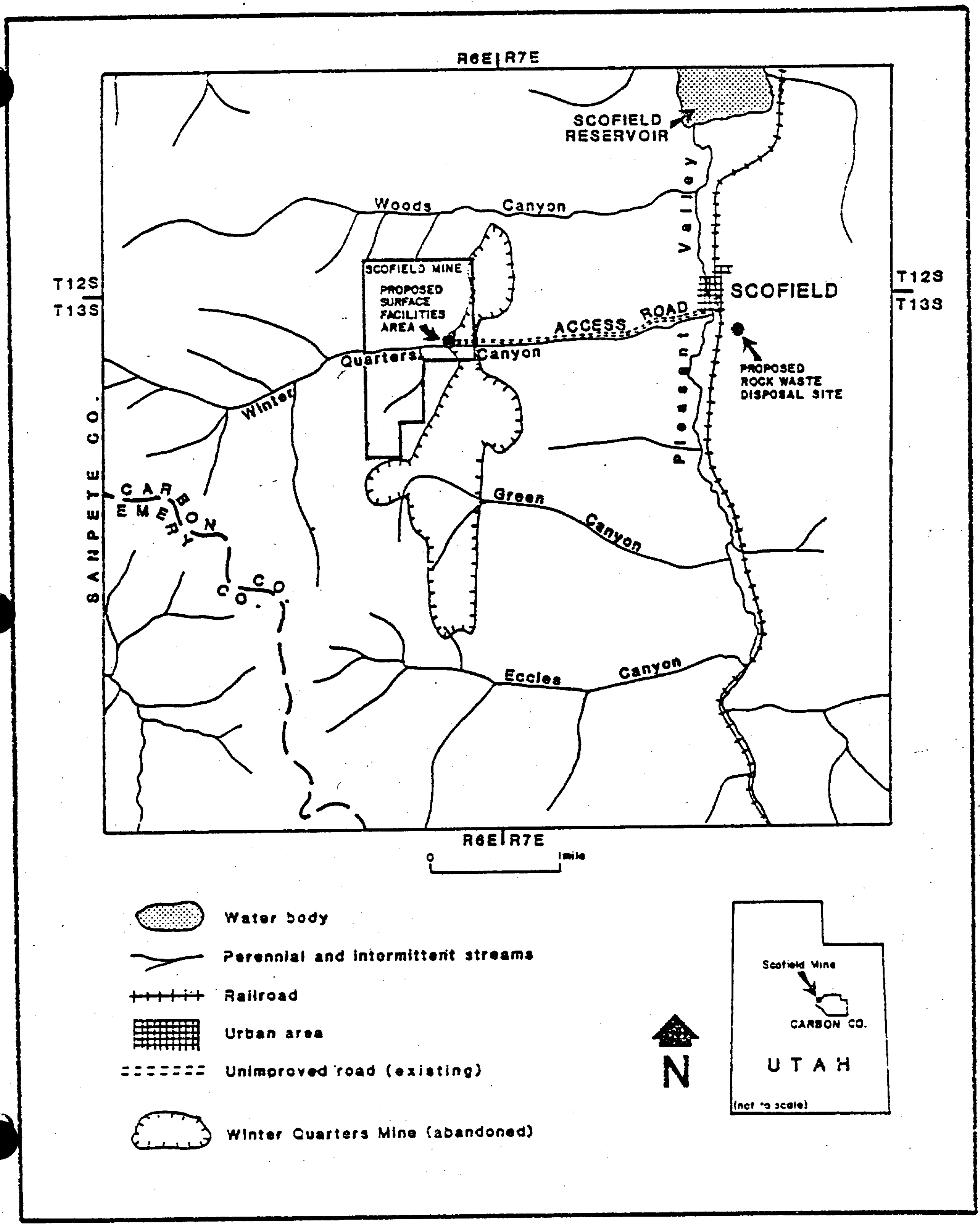
The mine project area is about 700 acres and includes areas to the west-southwest of Scofield. Areas to be disturbed include the surface facilities area at the mine entrance and a mine haul/access road. The surface facilities area will be in Winter Quarters Canyon adjacent to Winters Quarter Creek in the NE¼ of Sec. 1, T. 13 S., R. 6 E. (Figure 1). The haul/access road will follow the path of the present access road in Winter Quarters Canyon, connecting the surface facilities area and State Highway 96 due south of Scofield. The haul road will consist of widening the present access road and improving the road surface.

1.2 METHODS

1.2.1 Soil Inventory

First-order soil mapping of the areas to be affected (Figures 2 and 3) is a refinement of U.S.D.A. Soil Conservation Service (SCS) manuscript mapping, Carbon County, Utah. The SCS mapping is at a 2nd order level of intensity with a scale of 1:24,000. The SCS mapping in the site vicinity has a low amount of detail for a 2nd order survey and is comprised of broadly defined complexes. The base maps (Figures 2 and 3) used for the first-order mapping are enlarged aerial photographs at a scale of about 1:6,000 (1" = 500').

The detailed mapping was conducted during January 1981. Mapping was done by interpretation of aerial photographs based on field observations. Due to the mild winter there was no snow cover in Pleasant Valley and on the south-facing slopes in Winter Quarters



SCOFIELD MINE PROJECT AREA

FIGURE 1

Canyon. Most of the areas to be affected were bare of snow with the exception of parts of the bottom of Winter Quarters Canyon that had one foot of snow. However, field observations of the bare areas were limited by frozen soil.

Field observations consisted of traverses and sampling at the points labeled on the soil maps (Figures 2 and 3). Traverses were made along the access road which runs along the bottom of Winter Quarters Canyon and switchbacks up the hillside to the ridge top on the north side of the canyon. Soil profiles were exposed in Winter Quarters Canyon in a few stream cuts in the bottomland, a few gully and road cuts in the fans and footslopes, and along the continuous road cut in the hillside. Two backhoe pits were used to observe other soil profiles.

Six map units are used in this soil survey. One unit, RGF, is an SCS map unit. It occurs on north- and east-facing slopes that will be only slightly disturbed and so the level of detail given by the RGF unit is adequate. Because this survey is concerned with areas to be affected by surface disturbance, five new map units were named to provide more detail than the SCS map for those areas.

The major component soil series of the map units include four established series used by the SCS, a variant of a series used by the SCS, and an informal soil (CC). The CC soil was not mentioned in the SCS survey. The CC soil is an informal name used only in this survey; it is coined from the first letters of the subgroup and great group of its taxonomic classification, Cumulic Cryaquolls.

Typical profiles of the major soil series and the man-made fill in the areas to be affected were described in two backhoe pits (fill overlying CC, fill), one roadcut (Trag), and three auger holes (Silas, CC, Brycan coarse variant). The locations of these sampling points are shown on the soil maps. Two soil samples (#1 and #2), north of Scofield along the railroad tracks, were taken in that location because previous mine plans indicated surface disturbance there. Those plans have changed and that area will not be disturbed.

Several minor soils or soils to be only slightly affected were not sampled. The Falcon is a major soil of a unit (FaDE) which will only be slightly affected and so it was not sampled. Only about one-tenth acre of the FaDE unit will be disturbed by widening of the access road. The Croydon soil was not sampled because it will only be slightly disturbed. The Kunz soil is an inclusion in the TrE unit. It was not sampled because it is a minor soil and it is nearly identical to the sampled Trag, except its A horizon is thinner.

Profiles were sampled by horizon and analyzed for agronomic properties. Samples of the soil series and man-made fill were analyzed by Agricultural Consultants, Inc. of Brighton, Colorado. Parameters tested were particle size analysis (very fine sand, sand, silt, clay); textural class; saturated paste pH; electrical conductivity; saturation percentage; soluble calcium, sodium, and magnesium; sodium adsorption ratio; organic matter; lime; and available potassium and phosphorus.

The soils in the areas to be affected are evaluated as a source of reconstruction material. The evaluation method used is that of the SCS. Each horizon of each major soil series is rated for reconstruction material. The evaluation is based on the field description, analytical data, SCS official soil series description, and SCS Soil Interpretations Record. From this evaluation, recommended depths of topsoil material for each soil are given. In addition, the susceptibilities of the soils to wind and water erosion are tabulated. Erodibility is important to the evaluation of soil reconstruction material and to soil handling.

1.2.2 Land-Use Inventory

The land-use inventory collected information about present and potential uses and local land-use classifications. Information about present land use was gathered by field observations and by contacting landowners. Potential uses of the soils were evaluated based on field observations and SCS Soil Interpretations Records. Evaluations for potential uses include: (a) capability classes for non-irrigated and irrigated land, (b) potential natural forage production for favorable, normal and unfavorable years, and (c) important tree species. Local land-use classifications were obtained from the planning department of Carbon County, Utah.

2.0 SOIL SERIES CHARACTERISTICS, CLASSIFICATION, AND GENESIS

Soil series characteristics are described in Table 2.1. Characteristics included are: depth; drainage class; slopes; landform; parent material; the color, texture, presence of lime and thickness of the surface, subsoil and substratum of a representative profile; native vegetation; permeability; available water-holding capacity; and effective rooting depth. Table 2.1 contains all the information normally included in the text of a series description in an SCS soil survey.

Detailed profile descriptions are presented in Attachments B and C. Descriptions of sampled soils (locations in Figures 2 and 3) are presented on a modified SCS field description form (form 232) using a tabular format and abbreviations to allow a pedologist to easily retrieve the information (Attachment B). The abbreviations (Attachment A) used are standard SCS abbreviations (Soil Conservation Service: National Soils Handbook Part II 407.1(a)(3)iii; 1960; and 1951, p. 139).

SCS official soil series descriptions of the Croydon, Falcon, and Kunz soils, which were not sampled, are included in Attachment C. The Falcon soil is a major soil in the permit area but only a small acreage will be disturbed. The Croydon soil is a major soil which will not be disturbed. The Kunz soil is an inclusion in a map unit (TrE) that will be disturbed.

Climatic characteristics of the soil series as given by the SCS are presented in Table 2.2. Parameters include those in SCS official soil series descriptions. Also included are the data from the Town of Scofield U.S. Weather Bureau station at the dam on Scofield Reservoir. In several cases the given climatic ranges do not include the Scofield data. This is because the SCS is correlating these soils with other, similar soils first described elsewhere and the SCS has not yet revised the range of characteristics of the series.

Brief descriptions of the soil series and their characteristics pertinent to project development are presented in Section 2.1.

2.1 SOIL SERIES CHARACTERISTICS

2.1.1 Brycan Coarse Variant

The Brycan coarse variant consists of deep, well- or moderately well-drained, medium-textured soil. It occurs on alluvial fans and toeslopes in Winter Quarters Canyon. It is a variant because it is a member of the coarse-loamy rather than fine-loamy family. The mollic epipedon is usually thicker than allowed for the series. The profile sampled (profile no. 6) is located near the access road in Winter Quarters Canyon.

Table 2.1 Detailed Soil Series Descriptions

Soil Series (Map Unit Symbols)[a]	Depth	Drainage Class	Slopes	Landform and Parent Material	Representative Profile[b] Surface	Subsoil	Substratum	Native Vegetation	Perme-ability	Available[c] Water-Holding Capacity	Effective Rooting Depth
Brycan Variant (BrCD)	deep	well	sloping and mod. sloping	alluvial fans and toeslopes; sheetwash and alluvium derived from clastic sedimentary rocks	v. dk. brn. calc. GR-L 8 in. thick	dk. brn SL 16 in. thick	v. dk. brn. SL 36 in. thick calc. from 38 to 60 in.	big sagebrush and rabbitbrush	mod.	7 1/2-9 in.	60 in. or more
CC soil[d] (SIAU)	deep	poor	level	alluvial bottomlands; alluvium derived from clastic sedimentary rocks	v. dk. brn. L 29 in. thick	—	v. dk.gr.brn. calc. L 25 in. thick	grasses, sedges, and sphagnum moss	mod. to mod. slow	9-12 1/2 in.	60 in. or more
Croydon[e] (CrE, RGF)	deep	well	steep	north-, east-, and south-east-facing hillslopes; colluvium and residuum derived mostly from sandstone	v. dk. brn and brn. L 22 in. thick	v. pale brn. CB-SICL 26 in. thick	sandstone and shale	aspen, peavine, grasses, subalpine fir, Engleman spruce	mod. slow	6 1/2-10 1/2 in.	45 in. or more
Falcon[f] (FaDE)	shallow	well	sloping to steep	ridge crests, ridge spurs and hillslopes; residuum derived mostly from sandstone	v. dk. brn ST-FSL 7 in. thick	gr. brn. GR-L 7 in. thick.	hard sandstone	grasses	rapid	1/2-1 1/2 in.	0-20 in.
Silas (SIAB)	deep	somewhat poor to poor	nearly level to level	alluvial bottomlands; alluvium derived from clastic sedimentary rocks	v. dk. brn. L 45 in. thick	brn. calc. SL 10 in. thick	brn. calc. CL 6 in. thick	grasses and sedges	mod.	9 1/2-11 1/2 in.	60 in. or more
Trag (TrE)	deep	well	steep	south-facing hillslopes; colluvium and residuum derived from clastic sedimentary rocks	v. dk. brn. FL-L 10 in. thick	brn. GR-CL 35 in. thick	yel. brn. calc. FL-CL 15 in. thick	big sagebrush, rabbitbrush, and bitterbrush	mod. slow	8 1/2-10 in.	60 in. or more

[a] Map units in which the soil is a major component

[b] Abbreviations for texture are the ones used on SCS form 5; those for moist color are from Low, 1977; both are in Attachment A.

[c] Inches of water to 60 inches depth or shallower restricting layer (Forest Service, 1974).

[d] Not an established series.

[e] Not sampled; does not occur in area to be affected; soil is more cobbly than the typical pedon of the SCS official soil series description.

[f] Not sampled; negligible occurrence in area to be affected.

Table 2.2

SOIL SERIES CLIMATIC CHARACTERISTICS

Soil Series (Map Unit Symbol)[a]	Elevation at site (feet)	Average Annual Precipitation (in.)	(cm.)	Mean Annual Air Temperature (°F)	(°C)	Mean Annual Soil[b] Temperature (°F)	(°C)	Ave. Ann. Frost-Free Season (days)
Brycan coarse variant (BrCD)	7700-8200	16-18	41-46	37-39	3-4	39-41	4-5	60-80
CC soil (SiAB)	7640-8200	- - - - - not available, similar to Silas - - - - - -						
Croydon[c] (CrE, RFG)	7800-9350	18-26	46-66	36-38	2-3	38-42	3-6	50-65
Falcon (FaDE)	7700-9120	16-22	41-56	36-40	2-4	45-47	7-8	40-65
Silas (SiAB)	7640-8200	16-22	41-56	37-39	3-4	40-44	4-7	40-60
Trag (TrE)	7700-9120	16-22	41-56	36-40	2-4	45-47	7-8	40-65
Scofield[d] Weather Station (7 yr. record)	about7700	15.4	39	36.5	2.5	---	---	55

[a]Map units in which the soil is a major component.
[b]At 20 inches (50 cm) depth.
[c]Croydon soil series is typically on north-facing slopes. Croydon soils on east-facing slopes are in the warm end of the range. Croydon soils on southeast-facing slopes are probably warmer than the range given here.
[d]Personal communication from Arlo Richardson, Utah State Climatology Office, Logan, Utah.

Note: Climatic information for soil series is from SCS manuscript map unit descriptions or from SCS Soil Series Descriptions; that given for Brycan coarse variant is from Brycan Soil Series.

2.1.2 CC Soil

The CC soil consists of deep, poorly drained, medium-textured soil. It occurs in alluvial valley bottoms in Winter Quarters Canyon and in Pleasant Valley. Two profiles were sampled, one from Pleasant Valley and one overlain by 3 feet of coal-rich fill near the proposed surface facilities area in Winter Quarters Canyon (profiles no. 1 and 3, respectively).

The CC soil is an informal soil name set up for the purpose of this survey. The CC soil is a member of the fine-loamy, mixed Cumulic Cryaquolls. It was too limited in extent to be included in the SCS soil survey.

2.1.3 Croydon Series

The Croydon series consists of deep, well-drained, medium-textured soil. It occurs on the north-, east-, and southeast-facing slopes, which tend to be the more cold, moist portion of the hillslopes that support trees. The north-facing slopes support fir and spruce trees and the east- and southeast-facing slopes support aspen trees. There is usually an O horizon present. The soil does not occur within the area to be affected and therefore was not sampled.

2.1.4 Falcon Series

The Falcon series consists of shallow, well-drained, moderately coarse textured soil underlain by hard, sandstone bedrock. It occurs on ridge crests and spurs, and in thin bands above sandstone strata on the hillsides. The Falcon soil usually appears as light areas on aerial photographs due to the low density of vegetation.

The profile described in the SCS official soil series description (Attachment D). differs from the soils at the project area in that it is a non-gravelly and gravelly coarse sandy loam. The soils at the project area are typically stony fine sandy loams.

About one-tenth acre of this soil in the FaDE map unit will be disturbed when the access road is widened. Other small areas included in the TrE map unit will be disturbed at the surface facilities area. The Falcon soil was not sampled because of the limited extent of proposed disturbance.

2.1.5 Silas Series

The Silas series consists of deep, somewhat poorly and poorly drained, medium-textured soil. It occurs in the valley bottom in Winter Quarters Canyon and in Pleasant Valley. The water table is at a depth of about 3 feet during the summer, according to SCS field observations (Earl Jensen, Soil Survey Party Leader, Carbon Co.; personal communication, 1981). The profile sampled (profile no. 2) is located north of Scofield along Denver and Rio Grande Western Railroad tracks.

2.1.6 Trag Series

The Trag series consists of deep, well-drained, medium-textured soil. It occurs on the south-facing slopes, which tend to be the more warm, dry hillslopes in Winter Quarters Canyon. Boulders over 5 feet in diameter in places occur in this soil. The substratum is either lime-enriched colluvium or soft shale that has been slightly modified by creep motion and root penetration. Root penetration of the soft shale indicates it is a favorable growth medium for plants. One profile (profile no. 4) with the deep colluvial substratum was sampled at the proposed surface facilities area in the canyon.

2.2 SOIL CLASSIFICATION AND GENESIS

The classification of the soils is tabulated in Table 2.3. The soil name, family and subgroup are given. Soil classification is defined in Soil Taxonomy (SCS, 1975).

The major soils, including the Croydon which occurs under forest, have a dark, organic-rich surface horizon (mollic epipedon) typical of soils formed under grass. The dark surface horizon of the Brycan coarse variant is thicker (Cumulic) than those on the hillsides because it occurs in accumulated sediments on alluvial fans. The surface horizons of the Silas and CC soils in the alluvial bottomlands are thick (Cumulic) because they occur in accumulated sediments. Their surface horizons are very rich in organic matter because their wet subsoils allow a greater production of vegetation than occurs on the other soils. The Silas and CC soils are subirrigated by the shallow groundwater table. The thick, dark, surface horizons of the Brycan coarse variant, CC, and Silas soils are indicative of geologically recent deposition of sediment. The surface horizon of these cumulative soils has grown thicker as the sediments accumulated.

Clay-enriched subsoil (argillic horizon) is a feature of the hillslope soils, Trag and Croydon. The associated, shallow (Lithic) Falcon soil lacks a clay-enriched subsoil. The Brycan coarse variant, CC, and Silas soils that formed in the young sediments of the fans and bottomlands and lack argillic horizons because they have not had much time to develop.

The soil temperature regimes found in the project area are the cryic and frigid regimes. The cryic soils are colder than the frigid during the summer. The principal factor affecting the soil temperature regimes is moisture, which is a function of aspect and depth to water table. Moisture increases the heat capacity of the soil and so wetter soils warm more slowly in the spring and are colder in the summer. Aspect influences soil moisture because it controls the amount of sunlight the

Table 2.3

CLASSIFICATION OF SOILS

Soil Series (Map Unit Symbols)[a]	Family	Subgroup
Brycan coarse variant (BrCD)	coarse-loamy, mixed	Cumulic Haploborolls
CC soil[b] (SiAB)	fine-loamy, mixed	Cumulic Cryaquolls
Croydon (CrE, RFG)	fine-loamy, mixed	Argic Cryoborolls
Falcon (FaDE)	loamy, mixed	Lithic Haploborolls
Silas (SiAB)	fine-loamy, mixed	Cumulic Cryoborolls
Trag (TrE)	fine-loamy, mixed	Typic Argiborolls

[a]Map units in which the soil is a major component.
[b]An informal soil; not an established series.

soil site receives. Sunlight increases evapotranspiration which leads to more rapid depletion of the soil moisture.

The cryic soils are the moister soils occurring on north- and east-facing slopes (Cryoborolls) and wet alluvial bottomlands with a high water table (Cryoborolls, Cryaquolls). The warmer frigid soils are on the south-facing hillslopes (Argiborolls, Haploborolls) and alluvial fans (Haploborolls). The south-facing hillslopes and alluvial fans are not forested so the soil receives more direct solar energy.

Soil temperature regime is important to this project because the cold summer temperature of the alluvial bottomlands (Silas and CC soils) makes them unsuitable for cultivated crops.

3.0 SOIL MAP UNITS

Soil map unit characteristics are described in Table 3.1. Characteristics included are: map unit symbol; name; major soil series and their percentages; minor inclusions; slopes and terrain; water erosion hazard for natural vegetation and bare soil; wind erosion hazard for bare soil; surface runoff; capability subclass; range site; and land use. Table 3.1 contains all the information included in map unit descriptions in SCS soil surveys. The information has been tabulated to make it concise; to make information retrieval easier; and to allow rapid comparisons between map units. Characteristics of the map units pertinent to project development are discussed below.

3.1 MAP UNIT BrCD - Brycan loam, coarse variant, 5 to 25 percent slopes

Due to previous mining, there has been substantial disturbance of this map unit on the north side of the creek in Winter Quarters Canyon. Most of the map unit was disturbed for foundations for the original mining community. Boulders and stones were used to make small retaining walls. Despite the disturbance, erosion has apparently been minimal; rilling is absent and gullying occurs only where it would occur naturally due to runoff from the higher hillslopes. Vegetation has reestablished itself to what appears visually to be a density equivalent to that on undisturbed Brycan coarse variant soils.

3.2 MAP UNIT CrE - Croydon loam, warm phase, 40 to 50 percent slopes

This map unit is similar to RGF except it occurs only on the southeast-facing slopes of generally south-facing canyon hillsides, whereas the RGF map unit is on the north- and east-facing slopes of generally north-facing canyon hillsides. One map unit of CrE occurs above the proposed surface facilities area in Winter Quarters Canyon.

3.3 MAP UNIT FaDE - Falcon stony fine sandy loam, 10 to 60 percent slopes

Only a small area of this unit will be disturbed. The disturbance will occur by widening the present access road in Winter Quarters Canyon where it crosses this unit for a short distance. Road widening may require some blasting since this unit usually overlies hard sandstone.

3.4 MAP UNIT RFG - Croydon loam, 30 to 50 percent slopes

This map unit occurs on north- and east-facing slopes on generally north-facing canyon hillsides. It supports a community of mixed aspen and conifers on the north-facing slopes and aspen on the east-facing slopes. It was not sampled because it will only slightly be disturbed.

Table 3.1 Soil Map Unit Characteristics

Map Unit Symbol	Name	Map Unit Components: Soil Series	Percent of Map Unit	Minor[a] Inclusions	Slopes and Terrain[b]	Water Erosion Hazard: Natural Vegetation	Water Erosion Hazard: Bare Soil	Wind Erosion Hazard for Bare Soil	Surface Runoff	Capa-bility Subclass[d]	Range Site	Land Use
BrCD	Brycan loam, coarse variant, 5 to 25 percent slopes	Brycan coarse variant	85	15% Brycan L, 5-25% slopes	sloping and moderately sloping fans and toeslopes in canyon; all aspects; slopes are short to medium length and are convex to straight	slight to[c] mod.	mod.	low	medium	6E nonirrig. 4E irrig.	mountain loam	range, irrig. pasture
CrE	Croydon loam, warm phase, 40 to 50 percent slopes	Croydon	90	small areas of: Trag FL-L, 40-50% slopes; Pachic Argiboroll (fine-loamy, mixed) L, 40-50%	steep southeast-facing hillslopes in canyon; slopes are long and concave to straight	mod.	high	low	medium	7E[e] nonirrig.	NA	wooded[g] range
FaDE	Falcon stony fine sandy loam, 10 to 60 percent slopes	Falcon	80	10% rock outcrop and small areas of: mod. deep Falcon ST-FSL, 10-60% slopes; Kunz ST-L, 10-60% slopes	sloping to steep crests of ridges and ridge spurs; mostly south-facing; slopes are short and convex	mod.	high to mod.	medium	rapid	7E nonirrig.	mountain shallow loam	range
RCF	Croydon loam, 30 to 50 percent slopes	Croydon	85	Small areas of: Beardall ST-L, 45-50% slopes; Brycan L, 15-30% slopes; Trag CN-L 30-60% slopes	steep, north- and east-facing hillslopes; slopes are short and concave-convex	mod.	high	low	medium	7E nonirrig.	NA	wooded[g] range
SIAB	Silas-CC loams, 0 to 5 percent slopes	Silas	60	none	nearly level bottom of Pleasant Valley and narrow bottom in canyon; contains stream channels; aspect negligible; slopes are short and generally concave; Silas is on higher and CC is on lower spots	none	slight to[f] none	low	slow	6W nonirrig. 6W irrig.[e]	wet meadow	irrig. pasture, range
		CC	40			none	none	low	very slow	7W nonirrig. 7W irrig.[e]	wet meadow	irrig. pasture, range
TrE	Trag flaggy loam 40 to 60 percent slopes	Trag	60	15% Kunz BYX-L, 40-60% slopes; 15% Falcon ST-FSL, 40-60% slopes; 10% Pachic Argiboroll (fine-loamy, mixed) L, 40-60% slopes	steep, south-facing hillslopes in canyon; slopes are long and medium and are generally straight; Trag and Kunz occur throughout; Falcon occurs in linear areas above sandstone strata; Pachic Argiboroll occurs mostly in drainage-ways	mod.	high	low	rapid	7E[e] nonirrig.	NA	range

[a]Abbreviations are standard SCS textural ones used in Soil Interpretations Records (form 5). They are presented in Attachment A.
[b]The canyon referred to is Winter Quarters Canyon.
[c]The most serious erosion results from gullying, which is mainly influenced by the condition of the hillslopes above this unit.
[d]If no irrigated capability is given, the soil is unsuitable for irrigation.
[e]Information is site specific and differs from SCS Soil Interpretations Records.
[f]Hazard is greater in Winter Quarters Canyon where the steeper (3-5%) slopes occur.
[g]Wooded range is not presently being exploited for wood products.
NA - SCS data not available.

3.5 MAP UNIT SiAB - Silas-CC loams, 0 to 5 percent slopes

This unit occurs in valley bottoms and consequently there is a shallow water table at two or more feet depth. The CC soil occurs in the low, wetter spots and the Silas occurs on the high, drier spots. Local relief within the unit is only about 2 to 3 feet in Pleasant Valley and about 5 feet in Winter Quarters Canyon. Included in this map unit are stream channels and their channel deposits.

A significant portion of this unit is covered by man-made fill. The unit is covered by railroad ballast along the existing Denver and Rio Grande Western Railroad tracks. In Winter Quarters Canyon it is covered by railroad ballast along an abandoned railroad spur and coal-rich fill along the road.

The fill along the road in Winter Quarters Canyon has been described and analyzed (profiles 3 and 5 in Attachment B; located on Figure 2). The material is a mixture of coal waste and soil in varying proportions. The saturation percentages (Table 4.3) and the presence of naturally established vegetation indicate that most of the fill is a suitable plant-growth medium (see Section 4.1.3). However, the coal waste in the fill is a coarse-grained and somewhat droughty material by itself. To improve the available water-holding capacity of this material, soil can be added. Some of the fill already has sufficient soil mixed with it to be suitable as a soil reconstruction material.

3.6 MAP UNIT TrE - Trag flaggy loam, 40 to 60 percent slopes

This map unit is somewhat variable. There are several types of substratum material, three included soil series, and variations in the size and amount of rock fragments. The substratum of the Trag soil is either deep, stony colluvium or soft shale altered by root penetration and creep. It is not possible to map these separately.

The soil series inclusions consist of one contrasting soil and two similar soils in parallel families (SCS, 1967). The contrasting, shallow Falcon soil occurs in linear patches over sandstone strata. It appears as light spots on aerial photographs, but not consistently enough to be mapped. The similar Kunz soil inclusions are like the Trag except the A horizon is thinner. The Pachic Argiboroll, fine-loamy, mixed inclusions are similar to the Trag except the A horizon is thicker. The Pachic Argiboroll occurs mainly along hillside drainageways.

Sizes and amounts of rock fragments are about the same in the Trag, Kunz, and Pachic Argiboroll. Sizes include pea gravels to large boulders. Amounts vary from about 10 to 45 percent greater than 2 mm by volume.

Excavation in this map unit will be hindered by shallow depth of bedrock underlying the Falcon soil and by occasional large boulders on the surface and in all the component soils. The Falcon soil can be stripped to bedrock. Where large boulders are present they should be removed prior to soil salvaging.

4.0 SOIL ASPECTS OF RECLAMATION

4.1 SOIL RECONSTRUCTION MATERIAL FOR DISTURBED LAND

4.1.1 Method of Evaluation

The criteria for evaluating soil as a plant growth medium suitable for reclaiming disturbed land are given in Table 4-1. The criteria include sodium adsorption ratio (SAR), salinity as indicated by electrical conductivity (EC), toxic materials, soil reaction (pH), available water-holding capacity, soil erodibility factor (K), wind erodibility group, texture, and coarse fragments.

Limits are given for good, fair or poor sources of reconstruction material. A good rating means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated fair can usually be vegetated and stabilized without modification. However, top dressing with better material or application of soil amendments to modify one or more properties may be used to increase performance of the fair material. Material rated poor should not be used for reclamation. Top dressing with better material may be necessary to establish and maintain vegetation over material rated poor.

4.1.2 Soil Chemical and Physical Properties

Chemical and physical data for the predominant soils of the areas to be affected were collected to evaluate the soils as a source of reconstruction material for disturbed lands and to provide baseline data on soil fertility. The methods used for soil chemical and physical analysis by Colorado Agricultural Consultants are reported in Table 4-2. The data are reported in in Table 4-3. The sampling locations are shown on the soil maps (Figures 2 and 3) by profile number. Other sources of information used to evaluate soils for reclamation are manuscript SCS soil survey information and Soil Interpretations Records. Parameters tested were particle size analysis (very fine sand, sand, silt, clay), textural class, saturated paste pH, electrical conductivity (EC), saturation percentage, soluble calcium, sodium and magnesium, sodium adsorption ratio (SAR), organic matter, lime, and available potassium and phosphorus.

Determinations of plant-available phosphorus and potassium were done to provide baseline data on the fertility status of the soils in accordance with the recommendations of the Utah Division of Oil, Gas and Mining (Guidelines for Management of Soils, Draft, 4/1/81). Phosphorus is important to root growth and helps to stimulate early plant growth which hastens maturity. Potassium is important to photosynthesis, helps to

Table 4.1

CRITERIA FOR SOIL RECONSTRUCTION MATERIAL FOR DISTURBED AREAS

Property	Good	Limits Fair	Poor	Restrictive Feature
1. Sodium Adsorption Ratio (SAR)	<5	5-12	>12	Excess sodium
2. Salinity (mmhos/cm)	<8	8-16	>16	Excess salt
3. Toxic Materials	low	medium	high	Toxicity
4. Soil Reaction (pH)	5.6-7.8	4.5-5.5	<4.5	Too acid
5. Soil Reaction (pH)	5.6-7.8	7.9-8.4	>8.4	Excess lime, Too alkaline
6. Available Water-Holding Capacity (in./in.)	>.10	0.5-.10	<.05	Droughty
7. Soil Erodibility Factor (K)	<.37	≥.37	---	Water erodibility
8. Wind Erodibility Group	> 3	3	1,2	Wind erodibility
9. USDA Texture	---	SCL,CL, SICL	C,[b] SIC,[b] SC	Too clayey
10. USDA Texture	---	LCOS,LS, LFS,LVFS	COS,S, FS,VFS	Too sandy
11. Coarse Frag. (wt. pct.)				
3-10 in.	<15	15-35	35	Large stones
>10 in.	< 3	3-10	10	Large stones

Adapted from National Soils Handbook, NSH - Part II (403.6(a)), (Soil Conservation Service, no date)

[a]Layers with high potential acidity should be rated poor.
[b]If in kaolinitic family, rate one class better if experience confirms.

Table 1.2

SOIL ANALYSES: METHODS

AGRICULTURAL CONSULTANTS INC
240 SOUTH FIRST AVE
PO DRAWER 507
BRIGHTON, COLORADO 80601
(303)-659-2313

DATE: JANUARY 30, 1981

REPORT TO: JAMES P. WALSH

COMPANY: JAMES P. WALSH & ASSOCIATES, INC., 465 GRAPE AVENUE, BOULDER, CO 80302

PROJECT ID: 30 UCO SOIL SAMPLES

DESCRIPTION OF ABBREVIATIONS USED FOR SOIL TEST REPORT COLUMN HEADINGS

PH- PASTE PH

EC- ELECTRIC CONDUCTIVITY, MMHOS/CC, , USDA HANDBOOK 60 CHAPT 6 (4) CONDUCTIVITY ELECTRODE/WHEATSTONE BRIDGE

SAT%- WATER HOLDING CAPACITY AT SATURATION , USDA HANDBOOK 60 CHAPT 6 (3D)

CA- CALCIUM, MEQ/L, , USDA HANDBOOK 60 CHAPT 6 (8)/QUANTITATION BY AAS

MG- MAGNESIUM, MEQ/L, , USDA HANDBOOK 60 CHAPT 6 (9)/QUANTITATION BY AAS

NA- SODIUM, MEQ/L, , USDA HANDBOOK 60 CHAPT 6 (10A)/QUANTITATION BY AAS

SAR- SODIUM ADSORPTION RATIO, , USDA HANDBOOK 60 CHAPT 5 (PP72)/QUANTITATION BY AAS

TEXT- TEXTURE CLASS, , USDA HANDBOOK 60 CHAPT 6 (42B)/ASTM D 422-72

SN- SANDY OR SAND (%), USDA DIAGRAM

SI- SILTY OR SILT (%), USDA DIAGRAM

CL- CLAY (%), USDA DIAGRAM

VFS- VERY FINE SAND (%), USDA DIAGRAM

OM- ORGANIC MATTER (HUMUS), % AMER SOC OF AGR #9

P- PHOSPHORUS (AVAILABLE POTASSIUM, PPM, AMER SOC OF AGR #9 NAHCO3 EXT

AK- AVAILABLE POTASSIUM, PPM, AMER SOC OF AGR #9

L- LIME, % , USDA HANDBOOK 60 CHAPT 6 (23) CACO3 EQV

Table 4.3

SOIL ANALYSES: DATA

UCD SOILS/HOLE NUMBER 1 CC soil

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT	SN	SI	CL	VFS	OM	LM	AK	P
UCD	1	0 TO 7	A11	6.6	1.9	66.4	3.14	8.30	5.02	1.2	SICL	6	52	42	6	6.5	1.2	870	8
UCD	1	7 TO 16	A12	6.7	1.5	42.3	2.47	7.56	3.15	1.1	SILO	20	60	20	17	6.2	1.1	350	3
UCD	1	16 TO 29	A13	7.3	1.2	41.8	2.50	7.65	1.59	1.2	LO	43	41	16	19	1.9	0.8	360	2
UCD	1	29 TO 42	C1	7.2	2.2	36.3	2.87	11.55	3.67	1.0	LO	27	47	26	14	2.3	1.6	310	2
UCD	1	42 TO 64	C2ca	7.7	1.7	43.3	1.61	9.25	3.08	0.6	LO	34	40	26	16	1.6	9.1	290	1

UCD SOILS/HOLE NUMBER 2 Sitas Series

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT	SN	SI	CL	VFS	OM	LM	AK	P
UCD	2	0 TO 16	A11	7.3	1.9	39.6	3.51	9.09	3.37	1.4	LO	35	50	15	20	5.1	1.0	290	5
UCD	2	16 TO 24	A12	7.4	1.6	30.3	3.63	6.27	3.48	1.6	SILO	28	52	20	19	2.4	0.8	220	2
UCD	2	24 TO 35	A11b	7.4	1.2	43.0	2.43	5.58	1.55	1.3	SILO	23	51	26	16	2.2	0.8	250	2
UCD	2	35 TO 45	A12b	7.6	1.2	43.0	2.43	6.51	1.55	1.2	LO	34	47	19	19	2.0	0.9	240	1
UCD	2	45 TO 55	C1cab	7.9	1.5	37.8	2.76	8.46	1.76	1.2	LO	44	40	16	16	1.1	8.0	220	1
UCD	2	55 TO 61	C2cab	7.9	1.6	45.4	2.10	7.93	2.94	1.0	CLLO	28	42	30	14	1.6	0.2	320	1

UCD SOILS/HOLE NUMBER 3 Fill overlying CC soil

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT	SN	SI	CL	VFS	OM	LM	AK	P
UCD	3	0 TO 20	FILL1 & FILL2	6.9	2.6	35.0	1.99	13.04	1.53	0.7	SNLO	61	37	2	12	7.9	0.0	730	7
UCD	3	20 TO 35	FILL3 & FILL4	7.3	2.0	34.2	3.06	11.71	0.98	1.2	SNLO	56	33	11	14	5.3	1.7	420	3
UCD	3	35 TO 45	A11b1 & A12b1	7.2	1.4	36.3	2.07	8.81	0.92	1.3	SILO	24	58	18	17	4.9	0.9	310	1
UCD	3	45 TO 57	A11b2 & A12b2	7.4	1.1	37.0	2.82	6.48	0.90	1.5	LO	46	38	16	19	2.7	0.7	330	2
UCD	3	57 TO 68	A13b2	7.3	1.0	40.4	2.58	5.94	0.99	1.4	LO	35	43	22	11	3.4	0.8	360	1
UCD	3	68 TO 95	Cb2	7.2	1.8	37.1	3.75	9.71	1.80	1.6	LO	43	39	18	16	2.5	0.7	300	2

UCD SOILS/HOLE NUMBER 4 Trag Series

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT	SN	SI	CL	VFS	OM	LM	AK	P
UCD	4	0 TO 10	A1	7.2	1.1	39.4	2.65	4.06	1.69	1.6	LO	49	36	15	17	3.3	0.8	820	4

Table 4.3 continued

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT.	SN	SI	CL	VFS	OM	LM	AK	P
UCO	4	10 TO 19	B21t	7.0	1.1	46.5	1.44	6.31	4.62	0.8	CLLO	32	36	32	11	1.3	0.7	780	6
UCO	4	19 TO 45	B22t	7.4	1.2	37.8	1.69	7.60	4.33	0.9	LO	38	38	24	16	1.1	0.9	410	2
UCO	4	45 TO 60	B3CA	7.7	1.5	39.9	2.62	8.02	1.67	1.2	LO	37	39	24	16	0.9	2.5	240	1
UCO	4	90 TO 100	Cca	8.0	1.2	38.3	2.72	7.31	1.74	1.3	LO	49	34	17	16	0.8	4.6	270	2

UCO SOILS/HOLE NUMBER 5 FILL

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT.	SN	SI	CL	VFS	OM	LM	AK	P
UCO	5	0 TO 13	FILL1	7.0	2.0	36.9	1.88	8.66	1.80	0.8	LO	40	40	20	14	5.7	1.5	1030	4
UCO	5	13 TO 35	FILL2 & FILL 3	7.3	2.2	37.9	2.76	11.58	1.76	1.1	SNLO	58	31	11	14	7.5	5.5	600	1
UCO	5	35 TO 66	FILL4 & FILL 5	7.3	1.4	36.4	3.83	7.70	1.83	1.8	LO	41	42	17	17	4.5	1.2	400	1
UCO	5	66 TO 75	Cb	7.3	1.2	42.1	3.30	4.75	1.58	1.9	LO	47	38	15	17	4.1	1.0	440	1

UCO SOILS/HOLE NUMBER 6 Brycan coarse variant

HOLE NO.		DEPTH IN.	HORIZON	PH	EC	SAT%	NA	CA	MG	SAR	TEXT	SN	SI	CL	VFS	OM	LM	AK	P
UCO	6	0 TO 8	A11 & A3	7.4	1.5	41.8	2.50	6.70	1.59	1.2	LO	44	42	14	20	5.2	2.3	590	3
UCO	6	8 TO 24	B2	7.5	1.8	33.6	3.11	3.57	5.96	1.4	SNLO	66	23	11	11	1.8	0.6	890	1
UCO	6	24 TO 38	C1	7.7	2.4	33.4	3.12	4.79	5.99	1.3	SNLO	65	26	9	16	2.0	0.9	1090	1
UCO	6	38 TO 60	C2	8.0	2.7	35.3	2.96	4.54	5.67	1.3	SNLO	55	33	12	16	1.5	1.2	1470	1

stimulate root growth, and promotes disease resistance. Evaluations of whether values are high, medium, or low are dependent on the plant species selection (Barrett et al., 1980) in the reclamation plan. Therefore, relative ratings of available phosphorus and potassium levels are not given here.

4.1.3 Suitability as a Source Material for Reclamation of Disturbed Lands

Table 4.4 is an evaluation of soil reconstruction material for each horizon of the soils in the area to be affected. The evaluation is based on the soil chemical and physical data in Table 4.3 using the criteria of Table 4.1. The soils are rated good, fair, or poor sources of reconstruction material. The overall rating given for each horizon is the rating for the most limiting criterion. Depths of suitable material are summarized in Table 4.5.

The soils are nonsaline and nonsodic. Sodium adsorption ratio (SAR) is less than 1.6 for all samples tested. The EC is 2.7 or less for all samples tested. The soils are rated good for SAR and EC.

The soils are rated good for toxic materials. Some elements, such as boron and selenium, can be deleterious to plants or the animals that feed on them. Boron accumulates with salts in saline soils. Since these soils are nonsaline they are judged to be low in boron. No selenium plant indicators (Astragalus) were found at the site and so the soils are judged to be low in selenium (Barrett et al., 1980).

The soils have favorable reactions, as measured by pH. Excessively high or low pH may cause problems in establishing protective vegetation and influence the erodibility of the surface. The soils are rated good to fair for pH. The substrata of Silas and Brycan coarse variant are rated fair with a pH of 7.9 to 8.0. The slightly high pH is due to a slight excess of lime.

Available water-holding capacity (AWHC) is a measure of the moisture available to plants in the soil profile. AWHC is estimated based on field texture and percent coarse fragments (Forest Service, 1974) for most of the soils and by the SCS Soil Interpretations Record for the Falcon series. Estimations of AWHC can be checked by a relative comparison of the values of the saturation percentage, because soils with larger AWHC have a larger saturation percentage (Salinity Laboratory Staff, 1969).

The soils have good available water-holding capacity except the Falcon and the fill material, which are rated fair. These materials are rated fair because their sandy textures cannot hold much available water. This problem can be ameliorated by mixing of these materials with the other, finer-textured soils.

The soils of the project area are rated good to fair for water

Table 4.4

EVALUATION OF SOIL RECONSTRUCTION MATERIAL FOR AREAS TO BE DISTURBED

Soil Series (Map Unit Symbols)[a]	Horizon	Depth (in.)	SAR	Salinity	Toxic[b] Mater-ials	Soil Reaction	Available Water-Holding Capacity	Erosion Factor (K)	Wind Erodibility Group	USDA Text.	Coarse Frags.	Overall Rating
Drycan	A11 & A3	0- 8	good	good	good	good	good	good	good	good	good	GOOD
coarse	B2	8-24	good	good	good	good	good	good	fair	good	good	FAIR
variant	C1	24-38	good	good	good	good	good	good	fair	good	good	FAIR
(DrCO)	C2	38-60+	good	good	good	fair	good	good	fair	good	good	FAIR
Croydon[c]	--	0-22	good	good	good	good	good	good	good	good	fair	FAIR
loams	--	22-48	good	good	good	good	good	good	good	fair	fair	FAIR
(CrE,RGF)	--											
CC soil	A11	0- 7	good	good	good	good	good	good	good	good	good	GOOD
(...S)	A12	7-16	good	good	good	good	good	good-fair	good	good	good	GOOD-FAIR
	A13	16-29	good	good	good	good	good	good-fair	good	good	good	GOOD-FAIR
	C1	29-42	good	good	good	good	good	fair	good	good	good	FAIR
	C2	42-64+	good	good	good	good	good	fair	good	good	good	FAIR
Falcon[c]	A1	0- 7	good	good	good	good	fair	good	fair	good	fair	FAIR
(FaBE)	C	7-14	good	good	good	good	fair	good	fair	good	fair	FAIR
Silas	A11	0-16	good	good	good	good	good	good	good	good	good	GOOD
(SiAB)	A12	16-24	good	good	good	good	good	fair	good	good	good	FAIR
	A11b	24-35	good	good	good	good	good	fair	good	good	good	FAIR
	A12b	35-45	good	good	good	good	good	fair	good	good	good	FAIR
	C1cab	45-55	good	good	good	fair	good	fair	good	good	good	FAIR
	C2cab	55-61+	good	good	good	fair	good	good	good	fair	good	FAIR
Trag	A1	0-10	good	good	good	good	good	good	good	good	fair	FAIR
(TrE)	B21t	10-19	good	good	good	good	good	good	good	fair	fair	FAIR
	B22t	19-45	good	good	good	good	good	good	good	fair	fair	FAIR
	B3ca	45-60+	good	good	good	good	good	good	good	fair	fair	FAIR

[a] Map units in which the soil is a major component.

[b] See discussion in text, section 5.2.

[c] Not sampled; minor occurrence in area to be disturbed; evaluation based on SCS Soil Interpretation Record and field observations.

Table 4.5

DEPTHS OF SUITABLE TOPSOIL MATERIAL
FOR AREAS TO BE DISTURBED
(by map unit)

Map Unit Symbol	Components	Percent of Map Unit	Depth (in.)	Rating	Recommended Depth of Suitable Material (restrictive feature)
BrCD	Brycan coarse variant	85	0- 8 8-60+	good fair	60 in. (wind erodibility, alkaline pH)
	Brycan	15	0-60+	good-fair	60 in. (alkaline pH in substratum)
CrE	Croydon	90	0-48	fair	48 in. (large stones)
	other soils	10	variable	variable	to bedrock
FaDE	Falcon	80	0-14	fair	10 in. or to rock (large stones, wind erodibility, droughty)
	Rock Outcrop	10	0	no soil	---
	mod. deep Falcon	0-10	0-30	fair	(large stones, wind erodibility, droughty)
	Kunz	0-10	0-50	fair	(large stones, clayey)
RGF	Croydon	85	0-48	fair	48 in. (large stones)
	other soils	15	variable	variable	to bedrock
SiAB	Silas	60	0-16 16-61+	good fair	60 in. (water erodibility, excess lime, clayey)
	CC soil	40	0- 7 7-29 29-64+	good good-fair fair	60 in. (water erodibility)
TrE	Trag	60	0-60+	fair	60 in. (large stones, clayey)
	Falcon	15	0-14	fair	10 in. or to rock (large stones, wind erodibility, droughty)
	Kunz	15	0-60+	fair	60 in. (large stones, clayey)
	Pachic Argiboroll,	10	0-60+	fair	60 in.

erodibility (Table 4.4). Water erodibility is indicated by the K factor (Table 4.6), which is explained more fully in Section 4.2. K values for sampled soils are calculated using the laboratory data in Table 4.3 (Wischmeier and Smith, 1978). K values for the Falcon series are from the SCS Soil Interpretations Record.

The subsoil of Silas and subsoil and substratum of the CC soil are rated fair for water erodibility. The higher water erodibility is due to their high content of silt and very fine sand. Their surface horizons are less erodible because the large amount of organic matter binds the particles together. Water erodibility of these soils is not expected to be a problem because their subsoils will not be disturbed, and the terrain at the proposed railroad loadout is nearly level. The subsoil and substratum of Trag are not erodible because their high content of coarse fragments acts as a mulch (Wischmeier and Smith, 1978, p. 10).

The soils of the site are rated good to fair for wind erodibility. Wind erodibility is rated from the wind erodibility group (WEG; see Section 4.2). The sandy loams of the Falcon soil and the subsoil and substratum of the Brycan coarse variant are rated fair.

Soil textures at the site are rated good to fair. Texture influences available water-holding capacity, erodibility by wind or water, soil structure, consistence, water intake rate, runoff, fertility, workability, trafficability, and potential slippage hazard. The Trag below 10 inches is rated fair because the horizons are clay loams. This will be ameliorated during stripping by mixing of these horizons with the less clayey surface of Trag and with the sandy loam of the Falcon soil which is included in the TrE map unit. The Silas below 55 inches is rated fair; the substratum will not be affected, however.

The Brycan variant, CC, and Silas soils are rated good for coarse fragments; the Falcon and Trag are fair. Coarse fragments influence the ease of excavation, stockpiling, respreading, and suitability for the final land use. A certain amount of coarse fragments can be tolerated depending upon the size and the intended use of the reclaimed area. Evaluations of coarse fragments are based on profile descriptions for the sampled soils and on the SCS Soil Interpretations Record for the Falcon series. Coarse fragments are a restrictive feature for the Trag and Falcon series and minor included soils on the hillslopes. In some areas these soils have large stones and boulders. Although coarse fragments of the soils on the hillslopes reduce their workability, they will be advantageous for minimizing erosion on topsoil stockpiles and redressed soil on steep slopes.

The fill material left from the previous mining (profiles 3 and 5, not shown in Table 4.4) is good to fair for soil reconstruction material with the exception of the top 2 horizons of profile 3. These fill horizons are too droughty, but the problem could be rectified by mixing in some finer-textured topsoil. The fair rating for some other fills (fill horizons 2 to 5 in profile 5) is due to moderate wind or water erodibility which is partly due to the properties of the admixed soil.

The overall ratings of the soils are good to fair. There will be plenty of soil reconstruction material. Overall, all the soils are rated good to fair to a depth of 60 or more inches, except for the shallow Falcon series. Except for the Falcon, the soils can be stripped to the depth required for an adequate volume of reclamation material.

4.2 SOIL ERODIBILITY

Soil erodibility is an important consideration in the selection of suitable soil reconstruction material and in reclamation planning. Erodibility can affect the success of reclamation and the amount of sediment generated by disturbance. The water erodibility factor (K) and wind erodibility group (WEG) were calculated (Table 4.6) to evaluate soil reconstruction material (Section 4.1.3) and for use in reclamation planning.

The water erodibility of soils (K factor) is calculated using the parameters of: percentages of silt, very fine sand, coarser sands, organic matter and coarse fragments; soil profile permeability; and type of soil structure (Wischmeier and Smith, 1978). Particle sizes and organic matter were measured in the laboratory. Coarse fragments, permeability and structure were estimated in the field. The larger the K factor, the greater is the susceptibility of the soil to water erosion. Other factors that must be considered in assessing water erosion on the site are rainfall intensity, slope steepness, length and shape, vegetative and plant litter cover, and erosion control practices.

The wind erodibility group (WEG) is estimated using SCS criteria based upon texture, presence of lime and coarse fragments (Forest Service, 1979). Wetness was not considered here, though it is by the SCS, because soils will dry out if they are stockpiled. The smaller the WEG number, the greater is the wind erodibility. Other factors important in assessing wind erosion at the site are the roughness of the soil, wind velocities, dryness of the soil surface, sheltering effects of woodlands and topographic rises, and vegetative and plant litter cover (Barrett et al., 1980).

4.3 SOIL HANDLING

In Winter Quarters Canyon, any areas that will be covered with artificial fill or will be compacted should be stripped of enough topsoil to provide an adequate volume for reclamation. Because of the long term of soil stockpiling, it is not worthwhile to separately stockpile the organic-rich surface (A horizons) and the underlying soil horizons. One stockpile can combine all horizons of all the hillslope soils (map units TrE and FaDE). If stockpiling of soils in the canyon bottom (map units BrCD, SiAB) is necessary, they should be stockpiled separately from the stony hillslope soils. The hillside soils have a low water erodibility (K factor, Table 4.6) which makes them ideal for

Table 4.6

SOIL ERODIBILITY

Soil Series (Map Unit Symbols)[a]	Depth (in.)	USLE Water[b] Erodibility Factor (K)	Wind Erodibility Group (WEG)
Brycan coarse variant (BrCD)	0- 8	0.25	5
	8-60+	0.20-0.29	3
CC soil (SiAB)	0-16	0.15-0.40	6
	16-42	0.30-0.39	5
	42-64+	0.38	5
Croydon[c] (CrE, RGF)	0-22	0.24	5
	22-48	0.32	6
Falcon (FaDE)	0- 7	0.10	3
	7-14	0.10	3
Silas (SiAB)	0-45	0.32-0.46	5
	45-61+	0.32-0.42	4L
Trag (TrE)	0-10	0.16	5
	10-45	0.16-0.19	6
	45-60+	0.19	6

[a]Map units in which the soil is a major component.

[b]Includes correction for coarse fragments (Wischmeier and Smith, 1978, p. 10).

[c]From SCS Soil Interpretations Record.

redressing steep slopes. In contrast, the soils of the canyon bottom are more erodible. The soils of the canyon bottom should be redressed on gentle slopes comparable to the ones on which they naturally occur. The topsoil stockpiles should be stabilized by mulch and vegetation, and be surrounded by a low ridge to prevent loss of eroded topsoil.

5.0 LAND USE

5.1 CAPABILITY AND CURRENT USE OF LAND

Current uses of the land are shown on a map (Figure 4) of the area at a scale of 1:6,000 (1" = 500'). Current land uses for each of the soil series, along with their capability classes for non-irrigated and irrigated use, potential natural forage production, and important tree species are presented in Table 5.1.

5.1.1 Grazing

Grazing within the project area occurs on irrigated pasture and unimproved range. The soils with the highest potential for the production of natural forage are the Croydon and Silas soils (Table 5.1).

Irrigated pasture on Silas, CC, and Brycan coarse variant soils occurs at the mouth of Winter Quarters Canyon. The hay is natural and unimproved and is harvested by grazing. The area is flood irrigated by blocking the flow in a ditch that runs parallel to the access road in Winter Quarters Canyon. The area is occasionally harrowed. About 100 cows with calves are run on an area of about 160 acres from May to October or November (Jensen, 1981).

The land in the permit area west of Section 5, T. 13 S., R. 7 E. and the hilly area in the NW quarter of Section 5 is used for sheep and cattle grazing, wildlife habitat, and watershed. The predominant soils are the Trag and Croydon soils. The area west of Section 5 is grazed from June through October (Allred, 1981). The area in Section 5 is grazed from May through October or November (Jensen, 1981).

5.1.2 The Potential for Cultivation and Prime Farmland Determination

Land-capability classes of the soils for non-irrigated management, and for irrigated management when applicable, are presented in Table 5.1. They show that the only soil that is at all suited for cultivation within the area to be disturbed is the Brycan coarse variant, 5 to 25 percent slopes. However, it occurs in areas too small to be cultivated and the uppermost slopes are too steep. All the other soils in the area to be disturbed are generally suitable only for grazing, wildlife habitat, and watershed.

A negative prime farmland determination has been made by Mr. T. B. Hutchings, the State Soil Scientist for the Soil Conservation Service in Utah (Attachment D). We concur with this finding. The factors limiting farming are steep slopes and stony soils on the hillsides in Winter

Table 5.1

PLANT PRODUCTION CAPABILITY
AND CURRENT USE OF SOILS

Soil Series (Map Unit Symbols)[a]	Slope Phase	Capability Class[b] Non-irrigated	Irrigated	Current Land Use	Potential Natural[c] Forage Production (lbs. dry wt./ac.) favorable/normal/unfavorable years	Important Tree Species
Brycan coarse variant (BrCD)	5-25% slope	6E[d]	4E[d]	range, access road, irrigated pasture, wildlife habitat, watershed	(1500/1000/700)[e]	none
CC soil (SiAB)	all	7W	7W[f]	irrigated pasture, range, wildlife habitat, watershed, access road	NA	none
Croydon (CrE, RGF)	all	7W	---	wooded range, wildlife habitat, watershed	5300/3050/2000	aspen
Falcon (FaDE)	all	7E[f]	---	range, wildlife habitat, watershed	NA	none[f]
Silas (SiAB)	all	6W	5W[f]	irrigated pasture, range, wildlife habitat, watershed, access road	4600/3800/3000	none
Trag (TrE)	10+% slope	7E[f]	---	range, wildlife habitat, watershed, access road	2000/1600/1200	none

--- = not applicable
NA = no data available

[a] Map units in which the soil is a major component.
[b] Classes 1 through 4 are suitable for cultivation with class 1 having the least limitations for cultivation and 4 the most. Classes 5 through 8 are unsuitable for cultivation with increasing severity of limitations. Limitations primarily caused by wetness or erosion factors are denoted by W or E, respectively.
[c] Data are from SCS Soil Interpretation Records.
[d] Same as for Brycan series.
[e] Data is for Brycan series.
[f] Information is site specific and differs from SCS Soil Interpretation Records.

Quarters Canyon, and cold soil temperatures in the bottomlands of Winter Quarters Canyon.

5.1.3 Forestry

The north-, east-, and southeast-facing hillslopes in Winter Quarters Canyon and on the adjacent ridges are woodlands. The woodland is not being utilized for wood products (Allred, 1981). No woodland will be disturbed.

5.1.4 Transportation Routes

The unimproved dirt access road in Winter Quarters Canyon is not an important route. It is used only for access to the rangelands within Winter Quarters Canyon. A locked gate presently restricts access on the road.

5.1.5 Recreation

Recreation in Winter Quarters Canyon is limited by the restriction of access to the area by the private landowner. Recreational users of the area must walk or ride horses to get into the area. Activities include hunting for deer and elk, and trout fishing (Allred, 1981).

5.2 HISTORIC LAND USE

Winter Quarters Canyon was the site of 5 underground coal mines which operated over the period from 1878 to the 1930's. While the Winter Quarters Mines were active, a mining community existed in the canyon to the east of the proposed surface facilities area. Relic buildings and foundations still exist along the access road in the canyon in Section 6 and the eastern part of Section 1.

5.3 LOCAL LAND USE CLASSIFICATION

The entire project area lies within Carbon County's newly created CE-2, Critical Environmental Zone. These CE-2 lands cover certain Mountain riparian and other lands of environmental concern in the county. However, these lands are of less critical concern than the CE-1 lands and consequently do allow for certain levels of mining. Major underground mines, when approved by the county commission and in accordance with the applicable provisions of Chapter 5-4 of the Development Code of Carbon County, Utah, are allowed within this CE-2 zone.

6.0 REFERENCES

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ATTACHMENTS

ATTACHMENT A

Abbreviations for

Soil Descriptions

ABBREVIATIONS FOR SOIL DESCRIPTIONS

(Soil Conservation Service: National Soils Handbook Part II 407.1(a)(3)iii; 1960; and 1951, p. 139-140)

COLOR (Low, 1977)

black......................bl.
blue......................blue
brown......................brn.
brownish gray...brn. gr., etc.
calcareous..............calc.
dark..................dk.
gray..................gr.
green...............grn.
pink................pink
red....................red
variegated..........varig.
white..................wh.
yellow...............yel.

MOTTLING

Abundance:
few (<2% of surface)................f
common (2020% of surface)............c
many (>20% of surface)..............m

Size:
fine (<5 mm)...........................1
medium (5-15 mm).......................2
coarse (>15 mm)........................3

Contrast (Variations of hue and chroma of matrix and mottles):
faint (closely related).....................................f
distinct (1-2 hues and several units in chroma and value)....d
prominent (several units in hue, value, and chroma)..........p

TEXTURE

Modifier:

BY	Bouldery
BYV	Very bouldery
BYX	Extremely bouldery
CB	Cobbly
CBA	Angular cobbly
CBV	Very cobbly
CN	Channery
CNV	Very channery
CR	Cherty
CRC	Coarse cherty
CRV	Very cherty
FL	Flaggy
FLV	Very flaggy
GR	Gravelly
GRC	Coarse gravelly
GRF	Fine gravelly
GRV	Very gravelly
MK	Mucky
PT	Peaty
SH	Shaly
SHV	Very shaly
SR	Stratified
ST	Stony
STV	Very stony
STX	Extremely stony
SY	Slaty
SYV	Very slaty

Texture or terms used lieu of texture:

VCOS	Very coarse sand
COS	Coarse sand
S	Sand
FS	Fine sand
VFS	Very fine sand
LCOS	Loamy coarse sand
LS	Loamy sand
LFS	Loamy fine sand
LVFS	Loamy very fine sand
COSL	Coarse sandy loam
SL	Sandy loam
FSL	Fine sandy loam
VFSL	Very fine sandy loam
L	Loam
lt	Light
SIL	Silt loam
SI	Silt
SCL	Sandy clay loam
CL	Clay loam
SICL	Clay loam
SC	Sandy clay
SIC	Silty clay
C	Clay
CE	Coporgeneous earth
CEM	Cemented
DE	Diatomaceous earth
FB	Fibric material
FRAG	Fragmental material
G	Gravel
hv	Heavy
GYP	Gypsiferous material
HM	Hemic material
ICE	Ice or frozen soil
IND	Indurated
MARL	Marl
MPT	Mucky-peat
MUCK	Muck
PEAT	Peat
SG	Sand and Gravel
SP	Sapric material
UWB	Unweathered bedrock
VAR	Variable
WB	Weathered bedrock
CIND	Cinders
ltCL	Light clay loam, etc.

STRUCTURE

Grade:
structureless.........0
weak..................1
moderate..............2
strong................3

Form or Type:
platy.................pl
prismatic.............pr
columnar..............cpr
blocky................bk
angular blocky.......abk
subangular blocky....sbk
granular..............gr
crumb.................cr
single grain..........sg
massive...............m

Size (differs with kind of structure as follows):

Size class	Diameter of granules	Thickness of plates	Diameter of blocks	Diameter of prisms
vf very fine or very thin*	<1 mm	<1 mm	<5 mm	<10 mm
f fine or thin	1-2 mm	1-2 mm	5-10 mm	10-20 mm
m medium	2-5 mm	2-5 mm	10-20 mm	20-50 mm
c coarse or thick*	5-10 mm	5-10 mm	20-50 mm	50-100 mm
vc very coarse or very thick*	>10 mm	>10 mm	>50 mm	>100 mm

*Read "thin" and "thick" for platy instead of "fine" and "coarse."

CONSISTENCE

Wet soil:
nonsitcky............so
slightly sticky......ss
sticky................s
very sticky..........vs
nonplastic...........po
slightly plastic.....ps
plastic...............p
very plastic.........vp

Moist soil:
loose..................l
very friable.........vfr
friable...............fr
firm..................fi
very firm............vfi
extremely firm.......efi

Cementation:
weakly cemented.......cw
strongly cemented.....cs
indurated.............ci

Dry soil:
loose..................l
soft...................s
slightly hard.........sh
hard...................h
very hard.............vh
extremely hard........eh

REACTION

Effervescence with HCl:
none..................eo
slight.................e
strong................es
violent...............ev

BOUNDARY

Distinctness:
abrupt (<1" thick)..................a
clear (1"-2½")......................c
gradual (2½"-5")....................g
diffuse (>5" thick).................d

Topography:
smooth (nearly a plane)..................s
wavy (pockets, width > depth)............w
irregular (pockets, depth > width).......i
broken (discontinuous)...................b

ROOTS

Abundance of roots by number and size

Code	Class	Very fine (1 mm)	Fine (1-2 mm)	Medium (2-5 mm)	Coarse (5-10 mm)
		Average number per square decimeter			
1	Few	<10	<10	<1	<1
2	Common	10 to 100	10 to 100	1 to 10	1 to 5
3	Many	≥100	≥100	≥10	≥5

Size:
very fine (<1 mm in diameter).......vf
fine (1-2 mm in diameter)............f
medium (2-5 mm in diameter)..........m
coarse (>5 mm in diameter)..........co

PORES

Abundance of pores by number and size

Code	Class	Very fine (0.1-0.5 mm)	Fine (0.5-2 mm)	Medium (2-5 mm)	Coarse (5-10 mm)
		Average number per square decimeter			
1	Few	<25	<10	<1	<1
2	Common	25 to 200	10 to 50	1 to 5	1 to 2.5
3	Many	≥200	≥50	≥5	≥2.5

Continuity:
discontinuous.....................dis
constructed......................cons
continuous.......................cont

Shape:
vesicular............................v
irregular or interstitial............i
tubular..............................t

Orientation:
vertical (within 45° of vertical).................ver
horizontal (within 45° of horizontal)..............hor
random (neither vertical nor horizontal)...........ran
oblique (near 45° to vertical or horizontal).......obl

CLAY FILMS

Frequency (% of ped faces and/or pores containing clay films:
very few (<5%)....................vl
few (5-25%).........................1
common (25-50%).....................2
many (50-90%).......................3
continuous (>90%)...................4

Thickness:
thin.................................n
moderately thick....................mk
thick................................k

Morphology:
clay films occur on faces of peds.................................pf
clay films line tubular or interstitial pores.....................po
oriented clay occurs as bridges holding mineral grains together................br
colloid stains mineral grains.....................................co

ATTACHMENT B

Descriptions of Sampled Soil Profiles of CC Soil, Silas Series, Fill Overlying CC Soil, Trag Series, Fill, and Brycan Coarse Variant

SOIL DESCRIPTION
Profile 1

Soil type: CC loam — Job: UCO — File No.: UCO

Classification: fine-loamy, mixed, Cumulic Cryaquoll — Date: 1-9-81 — Stop No.: 1

Area: Railroad : 1,170 feet north of mileage 15 marker, west of track

Legal Description: T. 12 S. R. 7 E. Section 32, 1700' S, 1540' W, NE corner

Vegetation: grasses, sedges and sphagnum moss; adjacent land is irrigated pasture

Parent Material: alluvium derived from sandstone and shale

Physiography: swale on valley floor

Relief: nearly level concave slope — Drainage: poor

Elevation: 7,665' — Gr. Water: at field capacity, below 20"

Slope: 1% — Moisture: moist throughout 0-10" frozen

Aspect: ----

Erosion Condition: none

Permeability: moderately slow

Current Use: railroad right of way

Climate: cryic, aquic

Salt or Alkali: none

Surface Stoniness: none

% Coarse Fragments*: 0

% Clay*: 20

% Coarser than V.F.S.*: 35

Field estimate of
*Control section average

Additional Notes:

0-7" - abundant coal chips

* - described and sampled by auger, not possible to describe boundary; structure is a crude estimate

Horizon	Inch Depth	Color Dry	Color Moist	Mottles	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	pH Reaction	Boundary	Roots	Pores	Clay Films	% Gr.	% Cob.	% St.	% Bld.	Sample
A 11	0-7	10 YR 4/2	10 YR 3/2	f1p 7.5 YR 5/8	L	2f gr*	sh	vfr	ss ps	6.6 ---	*	2m, f,vf		--	0	0	0	0	S
A 12	7-16	10 YR 4/2	10 YR 3/2	c1p 7.5 YR 5/8	L	1m & c gr	sh	vfr	ss ps	6.7 ---	---	2m,f 3vf		--	0	0	0	0	S
A 13	16-29	10 YR 4/2	10 YR 3/2	c1p 7.5 YR 5/8	L	1c gr	sh	vfr	ss ps	7.3 ---	---	2m,f 3vf		--	0	0	0	0	S
C 1	29-42	2.5 Y 4/2	2.5 Y 3/2	c1p 2.5 Y 6/2	L	m	h	vfr	ss p	7.2, e in pockets	---	2vf 1f		--	0	0	0	0	S
C 2 ca	42-64	2.5 Y 5/2	2.5 Y 3/2	c1p 2.5 Y 6/2	L	m	sh	vfr	ss p	7.7 es	---	1vf		--	0	0	0	0	S

SOIL DESCRIPTION
Profile 2

Soil type	Silas loam	Job: UCO	File No.: UCO
Classification	fine-loamy, mixed, Cumulic Cryoboroll	Date: 1-9-81	Stop No.: 2

Area	Railroad ; 660' N mile 15 marker, west of track				Additional Notes:
Legal Description	T. 12 S R. 7 E Section 32, 2200' S & 1500' W of NE corner				*described and sampled by auger, not
Vegetation	Grasses; adjacent land is used as irrigated pasture.				possible to describe boundary;
Parent Material	alluvium derived from sandstone and shale		Current Use	railroad right of way	structure is a crude estimate
Physiography	slight rise on valley floor		Climate	cryic, ustic	
Relief	nearly level, convex slope	Drainage somewhat poor	Salt or Alkali	none	55-61" contains fine pockets of lime
Elevation	7,650'	Gr. Water probably at 5 - 10'	Surface Stoniness	none	
Slope	1%	Moisture very moist	% Coarse Fragments*	0	
Aspect	---		% Clay*	25	
Erosion Condition	none		% Coarser than V.F.S.*	35	
Permeability	moderately slow		Field estimate of *Control section average		

Horizon	Inch Depth	Color Dry	Color Moist	Mottles	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	pH Reaction	Boundary	Roots	Pores	Clay Films	% Gr.	% Cob.	% St.	% Bld.	Sample
A 11	0-16	10 YR 4/2	10 YR 3/2	f1f	L	1f gr*	sh	vfr	ss ps	7.3 ---	*	1f		--	0	0	0	0	S
A 12	16-24	10 YR 4/3	10 YR 3/3	f1t	L	1f sbk	sh	fr	ss ps	7.4 ---	--	1f, m		--	0	0	0	0	S
A 11b	24-35	10 YR 4/2	10 YR 3/2	--	L	1f sbk	h	fr	ss ps	7.4 ---	--	2vf		--	0	0	0	0	S
A 12b	35-45	10 YR 5/3	10 YR 3/3	f1d gray	L	1f sbk	sh	fr	ss ps	7.6 ---	--	1vf, f,m		--	0	0	0	0	S
C 1ca	45-55	10 YR 6/2	10 YR 5/3	f1d gray	SL	m	sh	fr	ss ps	7.9 es	--	1vf, f,m		--	0	0	0	0	S
C 2ca	55-61	2.5 Y 5/2	10 YR 4/3	c 1&2 p orange	CL	1m sbk	h	fr	s p	7.9 es	--	none		--	5	0	0	0	S

SOIL DESCRIPTION
Profile 3

Soil type: Fill overlying CC soil		Job: UCO	File No.: UCO
Classification: 35+" fine-loamy, mixed, Cumulic Cryaquoll		Date: 1-10-81	Stop No.: 3

Area: Facilities area, flat just west of fan and below road			Additional Notes:
Legal Description: T. 13 S R. 6 E Section 1, 3350' N and 1410' W of SE corner			This site appeared to have been recently
Vegetation: barren; similar areas have grasses			bulldozed over with debris.
Parent Material: coal debris and soil mix over alluvium derived from sandstone & shale		Current Use	0-14" Entirely coal waste smaller than 1"
Physiography: alluvial bottomland		Climate: cryic, aquic	14-20" Mix of sandy gravel coal waste and
Relief: nearly level simple slope	Drainage: poor	Salt or Alkali: none	soil-gravelly loamy sand
Elevation: 8010'	Gr. Water: probably @ 10'	Surface Stoniness: --	20-29" Mix of soil and coal, including
Slope: 2%	Moisture: moist throughout	% Coarse Fragments*: 2	artifacts; has orange iron stains
Aspect: --		% Clay*: 28	29-35" Soil fill
Erosion Condition: --		% Coarser than V.F.S.*: 20	
Permeability: moderately slow		Field estimate of *Control section average for soil below 35"	

Horizon	Inch Depth	Color Dry	Color Moist	Mottles	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	pH Reaction	Boundary	Roots	Pores	Clay films	% Gr.	% Cob.	% St.	% Bld.	Sample
Fill 1	0-14	10 YR 2/1	10 YR 2/1		SG	sg	--	--	so po	6.9 e	aw	none		--	-	-	-	-	S
Fill 2	14-20	10 YR 2/1,3/2	Varig. 10 YR 2/1,3/2		SG	sg	--	--	so po	6.9 es	aw	none		--	-	-	-	-	
Fill 3	20-29	10 YR 4/1	10 YR 3/1*		GR lt. SCL	2f pl	sh	fr	ss ps	7.3 e	aw	none		--	15	0	0	0	S
Fill 4	29-35	10 YR 4/2	Varig. 10YR 3/4&4/3		GR SCL	2f pl	sh	fr	ss ps	7.3 -	as	none		--	20	0	0	0	
A11 b[1]	35-35½	10 YR 3/2	10 YR 2/2		SIL	1c sbk	sh	fr	ss ps	7.2 -	as	2f, vf		--	0	0	0	0	S
A12 b[1]	35½-45	10 YR 4/2	10 YR 3/2	clp orange	light CL	1c sbk	sh	fr	ss ps	7.2 -	aw	1f, vf		--	0	0	0	0	
A11 b[2]	45-46	10 YR 4/1	10 YR 3/1	clp orange	heavy L	1c sbk	sh	fr	ss ps	7.4 -	aw	1m,f vf		--	0	0	0	0	S
A12 b[2]	46-57	10 YR 4/2,4/1 5/2	Varig. 10 YR 3/2,3/1 4/2	m2f orange	heavy L	m	so-sh	fr	ss ps	7.4 -	gw	1m,f vf		--	2	0	0	0	
A13 b[2]	57-68	10 YR 4/1	10 YR 3/1	m1f orange	light CL	m	sh-h	fr	ss ps	7.3 -	gw	1f, vf		--	5	0	0	0	S
C b[2]	68-75	10 YR 4/1,5/2	10 YR Varig. 3/1,4/2	clp orange	stratif. SL & CL	m	sh	fr	ss ps	7.2 -	-	none		--	0	0	0	0	S

SOIL DESCRIPTION
Profile 4

Soil type: Trag flaggy loam — Job: UCO — File No.: UCO

Classification: fine-loamy, mixed, Typic Argiboroll — Date: 1-10-81 — Stop No.: 4

Area: Facilities area; roadcut on hillside about 200' west of fan at proposed facilities area

Legal Description: T. 13 S R. 6 E Section 1, 3390' N and 1570' W of SE corner

Vegetation: big sage, rabbitbrush and bitterbrush

Parent Material: colluvium and residuum derived from sandstone and shale

Physiography: backslope

Relief: very steep simple slope — Drainage: well

Elevation: 8050' — Gr. Water: none

Slope: 63% — Moisture: moist

Aspect: south

Erosion Condition: slight

Permeability: moderately slow

Current Use: range

Climate: frigid, ustic

Salt or Alkali: none

Surface Stoniness: class 3

% Coarse Fragments*: 25

% Clay*: 32

% Coarser than V.F.S.*: 25

Field estimate of
*Control section average

Additional Notes:

45-60" - Common fine filaments of lime

a Ped faces

b Ped interior

Boulders sometimes larger than 5' across

Horizon	Inch Depth	Color Dry	Color Moist	Mottles	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	pH Reaction	Boundary	Roots	Pores	Clay Films	% Gr.	% Cob.	% St.	% Bld.	Sample
A 1	0-10	10 YR 4/3	10 YR 3/2	--	FL-L	3 f&m gr	sh	vfr	ss ps	7.2 -	cw	2vf, f,m		none	10	10	6	2	S
B 21t	10-19	10 YR 5/3	10 YR 4/3	--	GR-CL	3 f & vf abk	sh	vfr	ss ps	7.0 -	gw	2f, vf,m		2n	12	8	6	2	S
B 22t	19-45	10 YR 5/3[a] 6/3[b]	10 YR 3/4[a] 4/4[b]	--	FL-CL	2m sbk	h	fr	s p	7.4 -	gw	1vf, f,m		3n	12	12	6	2	S
B3ca	45-60	10 YR 6/3	10 YR 5/4	--	FL -lt. CL	2m sbk	h	fr	s ps	7.7 es	di	1,vf f, m		1n	12	12	6	2	S
Cca*	60-80	2.5 Y 7/4	2.5 Y 5/4	--	SCL	1m sbk	sh	fr	ss ps	8.0 es	--	none		none	12	12	6	2	S

* sample taken for overburden study

SOIL DESCRIPTION
Profile 5

Soil type: Fill | Job: UCO | File No.: UCO

Classification: -- | Date: 1-10-81 | Stop No.: 5

Area: Facilities area; just east of alluvial fan		Additional Notes:
Legal Description: T. 13 S R. 6 E Section 1, 810' W and 3340' N, SE corner		0-13" Contains 50% coal fragments; also nails, ceramics, glass
Vegetation: big sage, rabbitbrush		
Parent Material: debris and soil	Current Use: range	13-30" as above but 75% coal fragments
Physiography: low alluvial terrace	Climate: frigid, ustic	30-35" as above; 50% coal fragments
Relief: gentle, simple slope / Drainage: moderately well	Salt or Alkali: none	35-62" few coal fragments up to 1/2"; mostly fine earth; no artifacts
Elevation: 7290' / Gr. Water: about 10'	Surface Stoniness: (snow cover)	
Slope: 5% / Moisture: moist throughout	% Coarse Fragments*: N/A	62-66" 50% coal fragments up to 1"; wood fragments present
Aspect: east	% Clay*: N/A	
Erosion Condition: --	% Coarser than V.F.S.*: N/A	66-75" 2% coal fragments up to 1/4"
Permeability: moderately slow	Field estimate of *Control section average	

Horizon	Inch Depth	Color Dry	Color Moist	Mottles	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	pH Reaction	Boundary	Roots	Pores	Clay Films	% Gr.	% Cob.	% St.	% Bld.	Sample
Fill 1	0-13	10 YR 3/1	10 YR 3/1	--	GR-L	1m gr	sh& lo	vfr	ss ps	7.0 e	cs	2vf		--	15	2	0	0	S
Fill 2	13-30	10 YR 2/1	10 YR 2/1	--	L	1m sbk	sh& lo	vfr	ss ps	7.3 es	as	1vf, f,m		--	5	2	0	0	S
Fill 3	30-35	10 YR 3/1	10 YR 3/1	--	L	1m sbk	sh& lo	vfr	ss ps	7.3 es	cs	1vf		--	5	2	0	0	
Fill 4	35-62	10 YR 5/2	10 YR 4/2	--	light CL	1m sbk	sh	fi	s p	7.3 e	cs	1f, m		--	5	2	1	0	S
Fill 5	62-66	10 YR 3/1	10 YR 3/1	--	GR-L	1m sbk	lo	vfr	ss ps	7.3 -	cs	2f		--	20	0	0	0	
C b	66-75	10 YR 4/2	10 YR 3/2	--	GR-L	m	sh	vfr	ss ps	7.3 -	--	none		--	15	0	0	0	S

N/A - Not Applicable

SOIL DESCRIPTION
Profile 6

Soil type: Brycan loam, coarse variant — Job: UCO — File No.: UCO

Classification: coarse-loamy, mixed — Cumulic Haploboroll — Date: 1-11-81 — Stop No.: 6

Area: Just above access road in canyon; about 400' W of gate, about 100' N of road

Legal Description: T. 13 S R. 7 E Section 6, 2600' W and 3390' N, SE corner

Vegetation: big sagebrush and rabbitbrush

Parent Material: alluvium derived from sandstone and shale

Physiography: alluvial fan

Relief: simple, mod. steep slope — Drainage: well

Elevation: 7830' — Gr. Water: none

Slope: 20% — Moisture: slightly moist below 8"; moist and frozen above

Aspect: south

Erosion Condition: slight

Permeability: moderate

Current Use: range

Climate: frigid, ustic

Salt or Alkali: none

Surface Stoniness: class 2

% Coarse Fragments*: 10

% Clay*: 24

% Coarser than V.F.S.*: 25

*Field estimate of Control section average

Additional Notes:

** - Augered 28 to 60 inches, not possible to describe boundary; structure is crudely estimated

Horizon	Inch Depth	Color Dry	Color Moist	Mottles	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	pH Reaction	Boundary	Roots	Pores	Clay Films	% Gr.	% Cob.	% St.	% Bld.	Sample
A 11	0-3	10 YR 5/2	10 YR 3/2	--	L	1vf sbk	so	lo	ss ps	7.4 e	cs	1f		--	3	2	0	0	S
A 3	3-8	10 YR 5/3	10 YR 3/3	--	GR-L	1m sbk	sh	vfr	ss ps	7.4 e	gs	2f, 1m		--	15	0	0	0	
B 2	8-24	10 YR 5/3	10 YR 3/3	--	SL	2m sbk	sh	vfr	ss ps	7.5 -	cs	1vf, f		--	8	2	0	0	S
C 1	24-38	10 YR 4/3	10 YR 3/2	--	SL	m	so	lo	ss ps	7.7 -	**	none		--	10	0	0	0	S
C 2	38-60	10 YR 5/3	10 YR 3/2	--	SL	m**	so	lo	ss ps	8.0 e	--	none		--	10	0	0	0	S

ATTACHMENT C

SCS Official Soil Series Descriptions
of Croydon, Falcon and Kunz Series

Established Series
Rev. EJ/JAC/AJE
11/74

CROYDON SERIES

The Croydon series consists of deep, well drained soils that formed in material weathered from sandstone. These soils are on north-facing mountain slopes. The mean annual precipitation is about 30 inches and the mean annual air temperature is about 38°F.

Soil Family: Fine-loamy, mixed Argic Cryoborolls.

Typical Pedon: Croydon loam, woodland. (Colors are for moist soil unless otherwise noted.)

01—1 inch to 0, leaves and other plant material. (1 to 4 inches thick)

A11—0 to 4 inches, very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak thick platy structure that parts to moderate fine granular; soft, friable, nonsticky and slightly plastic; many very fine, fine and coarse roots; slightly acid (pH 6.5); clear smooth boundary. (3 to 16 inches thick)

A12—4 to 16 inches, very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; soft, very friable, nonsticky and slightly plastic; many very fine through coarse roots; slightly acid (pH 6.5); abrupt broken boundary. (0 to 13 inches thick)

A2—16 to 22 inches, brown (10YR 4/3) heavy loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine through coarse roots; common fine pores; 20 percent gravel; 35 percent of this horizon is animal burrow material from A12 horizon above; slightly acid (pH 6.4); clear wavy boundary. (3 to 11 inches thick)

B21t—22 to 28 inches, light olive brown (2.5Y 5/4) silty clay loam, pale olive (5Y 6/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine and medium roots; common fine pores; common thin and many moderately thick clay films on faces of peds; small pockets of A12 horizon from animal burrows; slightly acid (pH 6.2); clear smooth boundary. (3 to 10 inches thick)

B22t—28 to 40 inches, light olive brown (2.5Y 5/4) silty clay loam, pale olive (5Y 6/3) dry; moderate coarse subangular blocky structure that parts to moderate fine subangular blocky; very hard, firm, sticky and plastic; few very fine and fine roots; common fine pores; continuous thin clay films on faces of peds; slightly acid (pH 6.2); clear smooth boundary. (6 to 31 inches thick)

C—40 to 48 inches, light olive brown (2.5Y 5/4) heavy silt loam, pale olive (5Y 6/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; slightly acid (pH 6.2); abrupt smooth boundary. (0 to 22 inches thick)

R—48 inches, weathered sandstone bedrock.

Type Location: Morgan County, Utah; about 8.5 miles east, and 4 miles north of Croydon, Utah; 1,475 feet south and 200 feet east of the NW corner of sec. 34, T.5N., R.5E.

Range in Characteristics: The mollic epipedon is 11 to 19 inches thick. The combined thickness of the A1, A2 and B2t horizons ranges from 39 to 53 inches. Soft weathered sandstone occurs at depths of 45 to more than 60 inches. The mean annual soil temperature at depth of 20 inches ranges from 39° to 42°F. The mean summer soil temperature ranges from 56° to 59°F. The soils are usually moist but are dry for 30 to 45 consecutive days during late summer. Rock fragments consist of rounded pebbles and cobbles, and range from 0 to 20 percent in the A1 horizon, 0 to 30 percent in the A2 horizon, 0 to 20 percent in the B2t horizon and 0 to 20 percent in the C horizon.

The A1 horizon has value of 3 through 5 dry, 2 or 3 moist, and chroma of 2 or 3 dry. It is loam or silt loam, medium acid to slightly acid, and is 11 to 19 inches thick.

The A2 horizon has hue of 10YR or 2.5Y, value of 5 through 8 dry, 4 through 6 moist and chroma of 2 through 4 dry and moist. It ranges from loam or cobbly loam to cobbly sandy loam. This horizon is slightly or medium acid and is 3 to 11 inches thick.

The B2t horizon has dominant hue of 2.5Y or 5Y (10YR in parts of some pedons), value of 5 through 7 dry and 4 or 5 moist, and chroma of 2 through 4 dry and moist. It ranges from silty clay loam to clay loam. This horizon has weak to moderate, fine to coarse subangular blocky structure. Clay films are common to continuous thin and few to many moderately thick on faces of peds. The B2t horizon is slightly or medium acid, and is 15 to 38 inches thick.

The C horizon has dominant hue of 2.5Y or 5Y (10YR in parts of some pedons), value of 5 through 7 dry, 4 or 5 moist, and chroma of 2 through 4 dry and moist. It ranges from silt loam to loam, gravelly loam, clay loam or silty clay loam. This horizon ranges from noncalcareous to moderately calcareous and is medium acid through neutral.

Competing Series: These are the Amsden, Archabal, Dra, Gelkie, Hourglass, Kezar, Kimmons, Leavitt, Lucky, Lymanson, Lyonman, Michelson, Miracle, Monida, Morset, Mult, Newlands, Oro Fino, Passcreek, Philipsburg, Primeaux, Rammel, Sponseller, Tingey, Tripit, Troutdale, Wellsville, Woosley and Youga series. All of these soils lack A2 horizons. Amsden, Dra, Gelkie, Kimmons, Leavitt, Lymanson, Michelson, Monida, Morset, Oro Fino, Passcreek, Philipsburg, Rammel, Tingey, Wellsville and Woosley soils have horizons of secondary calcium carbonate accumulation. Archabal soils are strongly acid. Hourglass soils have 20 to 35 percent rock fragments in the B2t horizon. Kezar, Kimmons, Lucky, Lymanson, Miracle, Mult, Newlands, Passcreek, Primeaux, Rammel, Tripit, Troutdale, and Woosley soils are 20 to 40 inches deep over bedrock. Lyonman soils have high chroma iron stains in the lower part of the B and upper C horizons and dominant hues of 10YR or redder. Newlands soils have hue of 10YR or redder in all parts of the B2t horizon. Sponseller soils have hue of 5YR or 2.5YR. Youga soils have A1 horizons 5 to 10 inches thick.

Geographic Setting: Croydon soils are at elevations of 6,400 to 8,300 feet. They occur on north-facing mountain slopes. Slopes range from 30 to 60 percent. These soils formed in residuum and local alluvium weathered from sandstone. The climate is humid and the average annual precipitation ranges from 25 to 35 inches. The mean annual temperature is 37° to 40°F. The mean summer temperature is 53° to 56°F., and the frost-free period ranges from 65 to 75 days.

Associated Soils: These are the Hades, Isbell, Kilfoil, Lucky Star, and Scave soils. Hades soils have mollic epipedons more than 20 inches thick and lack A2 horizons. Isbell soils have summer soil temperature greater than 59°F. and lack an A2 horizon. Kilfoil soils lack a mollic epipedon and are 20 to 40 inches deep to bedrock. Lucky Star and Scave soils have more than 35 percent rock fragments in the control section and have hue of 7.5YR, 5YR or 2.5YR.

Drainage and Permeability: Well drained; slow runoff; moderately slow permeability.

Use and Vegetation: These soils are used for watershed, range, wildlife habitat and timber production. The present native vegetation is aspen, white fir, Douglas-fir, snowberry, mountain bromegrass, ninebark, blue wildrye, peavine, sedges and willows.

Distribution and Extent: Northern Utah. This series is inextensive.

Series Established: Morgan Area, Morgan County, Utah, 1974.

National Cooperative Soil Survey
U. S. A.

Established Series
Rev. REM
4/74

FALCON SERIES

The Falcon series is a member of the loamy, mixed family of Lithic Haploborolls. Falcon soils typically have dark grayish brown very friable, granular A horizons, and light gray, gravelly coarse sandy loam, neutral C horizons over hard arkosic conglomerate at depth of about 14 inches.

Typifying Pedon: Falcon coarse sandy loam - open timber
(Colors are for dry soil unless otherwise noted.)

A1 0-7"--Dark grayish brown (10YR 4/2) coarse sandy loam; very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable; 10 percent gravel; neutral; clear smooth boundary. (5 to 10 inches thick)

C 7-14"--Light gray (10YR 7/2) gravelly coarse sandy loam; grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; extremely hard, very friable; 20 percent fine and very fine angular granite gravel; neutral; abrupt smooth boundary.

R 14-20"--Hard arkosic sandstone and conglomerate.

Type Location: Douglas County, Colorado; on the east side of Colorado State Highway 83, 500 feet north of the southwest corner of sec. 35, T.10S., R.66W.

Range in Characteristics: Base saturation typically is more than 80 percent but ranges from 60 to 100 percent. C horizons typically occur below the A horizon but in some pedons the A horizon rests on the R layer. Depth to the lithic contact ranges from 10 to 20 inches. The control section is usually gravelly coarse sandy loam, and has 5 to 18 percent clay, 5 to 35 percent silt, and 50 to 80 percent sand with more than 35 percent being fine or coarser sand. A large proportion of the sand fraction is medium, coarse, and very coarse angular sand which has a high percentage of flat bearing surfaces between sand grains. Rock fragments range from 0 to 35 percent and are mainly less than 3 inches in diameter but range from 1/8 to 10 inches in diameter. The solum and C horizons range from slightly acid to mildly alkaline. The mean annual soil temperature is 45°F., and the mean summer soil temperature is 62°F. Mean winter soil temperature is warmer than 32°F. and the soils are not continually frozen during the winter. The A horizon in most pedons has hue of 2.5Y through 7.5YR, value of 4 or 5 dry, 2 or 3 moist, and chroma of 1 through 3. The C horizon normally has hue of 2.5Y through 7.5YR. Subhorizons redder than 7.5YR occur in some pedons.

Competing Series and their Differentiae: These are the Corpening, Goldfield, Kloten, and Namur series. Corpening soils are calcareous, and have continuous horizons of secondary calcium carbonate accumulation. Goldfield soils are medium to moderately fine textured. Kloten soils are medium to moderately fine textured, have minor amounts of medium, coarse, and very coarse angular sand, and are frozen during most of the winter. Namur soils are less than 12 inches to bedrock, have medium to moderately fine texture, and have a high bulk calcium carbonate equivalent including coarse fragments of dolomite.

Setting: Falcon soils are on moderate to steeply sloping upland ridges and hills generally at the crests and shoulders of the highest parts of the landscape. Slope gradients range from 3 to 40 or more percent. The soils formed in materials weathered residually from the Dawson and similar arkose sedimentary beds overlying strata of hard sandstone and conglomerate. At the type location the average annual precipitation is 17 inches with peak periods of precipitation in the spring and summer.

Principal Associated Soils: These are the Kettle and Pring soils. Kettle soils have ochric epipedons and albic horizons. Pring soils lack bedrock above depth of 40 inches.

Drainage and Permeability: Well to somewhat excessively drained; medium runoff; rapid permeability above the bedrock.

Use and Vegetation: These soils are used primarily as native pastureland. In some localities they support stands of ponderosa pine of some importance for forestry. Native vegetation is primarily thin stands of ponderosa pine, Gamble oak, mountain-mahogany, and scattered grasses.

Distribution and Extent: The Black Forest areas of east-central Colorado. The series is of moderate extent.

Series Established: Cherry Creek Soil Conservation District, El Paso and Douglas Counties, Colorado, 1946.

National Cooperative Soil Survey
U. S. A.

Established Series
Rev. KMD/AJE
6/80

KUNZ SERIES

The Kunz series consists of deep, well drained soils that formed in material weathered from sandstone. Kunz soils are on mountain slopes and have slopes of 8 to 40 percent. The average annual precipitation is about 17 inches and the mean annual temperature is about 45° F.

Taxonomic Class: Fine-loamy, mixed Mollic Eutroboralfs.

Typical Pedon: Kunz cobbly loam - rangeland. (Colors are for dry soil unless otherwise noted.)

O1--1 inch to 0; decaying leaves.

A1--0 to 1 inch; dark brown (10YR 3/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; few medium, common fine and very fine intersititai pores; 25 percent cobbles; mildly alkaline (pH 7.4); abrupt smooth boundary. (1 to 4 inches thick)

B1--1 to 3 inches; dark brown (10YR 3/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; few medium and fine, and common very fine tubular pores; 25 percent cobbles; mildly alkaline (pH 7.6); abrupt smooth boundary. (0 to 3 inches thick)

B21t--3 to 17 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to strong medium, fine and very fine subangular blocky; very hard, firm, sticky and plastic; few coarse and medium, common fine and very fine tubular pores; many moderately thick clay films on faces and very fine tubular pores; many moderately thick clay films on faces of peds and in pores; 5 percent cobbles; mildly alkaline pH 7.8); gradual smooth boundary. (10 to 20 inches thick)

B22t--17 to 25 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure parting to strong coarse subangular blocky; very hard, firm, sticky and plastic; few coarse, fine and very fine roots; few medium and fine, and common very fine pores; common moderately thick clay films on faces of peds and in pores; 5 percent cobbles; mildly alkaline (pH 7.6); gradual smooth boundary. (7 to 19 inches thick)

B23t--25 to 37 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to strong coarse subangular blocky; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; many moderately thick clay films on faces of peds and in pores; 5 percent cobbles and 5 percent pebbles; mildly alkaline (pH 7.6); gradual smooth boundary. (11 to 24 inches thick)

B31--37 to 47 inches; brown (7.5YR 5/4) sandy clay loam, strong brown (7.5YR 4/6) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; few medium and fine, common very fine tubular pores; few thin clay films on faces of peds and in pores; mildly alkaline (pH 7.6); clear smooth boundary. (0 to 10 inches thick)

B32--47 to 60 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few coarse and medium, common fine and very fine tubular pores; neutral (pH 7.2).

Type Location: Washington County, Utah; about one mile east of Thorley Point in NE ¼ of section 9, T.39S., R.10W.

Range in Characteristics: The combined thickness of the A1, B1, B2t and B3 horizons ranges from 37 to 60 inches or more. The solum is mainly noncalcareous, but the B3 and C horizons where observed range from noncalcareous to moderately calcareous. The mean annual soil temperatuer at a depth of 20 inches ranges from 44° to 47° F. The mean summer soil temperature ranges from 59° to 62° F. The soils are usually moist during the period the soil temperature is above 41° F. They are dry for 60 to 75 days during the 120 days following the winter solstice.

The A1 horizon has hue of 10YR, 7.5YR or 5YR, value of 3 through 5 dry, 2 or 3 moist, chroma of 2 or 3 dry and 1 through 3 moist. It ranges from cobbly loam to fine sandy loam and has 0 to 25 percent rock fragments. This horizon is neutral or mildly alkaline.

The B2t horizon has hue of 10YR 7.5YR or 5YR, value of 4 through 6 dry, 3 through 5 moist, chroma of 3 through 6 dry and moist. It has 20 to 35 percent clay. Structure ranges from moderate to strong, medium and coarse prismatic and fine to coarse subangular blocky. Rock fragments range from 0 to 15 percent. This horizon is neutral or mildly alkaline.

Competing Series: These are the Hogg, Maitland and Wankon series. Hogg soils have a clay B2t horizon. Maitland soils are mainly medium to strongly acid. Wankon soils have free carbonates at a depth of 18 to 40 inches.

Geographic Setting: Kunz soils are on mountain slopes at elevations of 6,000 to 8,000 feet. Slopes range from 8 to 40 percent. These soils formed in residuum and colluvium weathered from sandstone, shale and limestone. The climate is moist subhumid and the average annual precipitation is 16 to 18 inches. The mean annual temperature is 42° to 45° F and the mean summer temperature is 60° to 63° F. The frost-free period ranges from 90 to 110 days.

Geographically Associated Soils: These are the Detra soils. Detra soils have a mollic epipedon more than 16 inches thick.

Drainage and Permeability: Well drained; medium runoff; moderately slow permeability.

Use and Vegetation: These soils are used for rangeland and wildlife habitat. Present native vegetation is Gambel oak, serviceberry, snowberry, Oregon grape, wild rose, lupine and tall native bluegrass.

Distribution and Extent: Southern Utah. These soils are of small extent.

Series Established: Canyonlands Area, San Juan Co. Utah, 1980.

National Cooperative Soil Survey

U. S. A.

ATTACHMENT D

Letter of Negative Prime Farmland Determination

United States Department of Agriculture

Soil Conservation Service

4012 Federal Building
125 South State Street
Salt Lake City, UT 84138

RECEIVED
MAR 26 1981
UCO, INC.

March 25, 1981

J. Chris Carter
Manager-Environmental Affairs
UCO Incorporated
1580 Lincoln - Suite 530
Denver, Colorado 80203

Dear Mr. Carter:

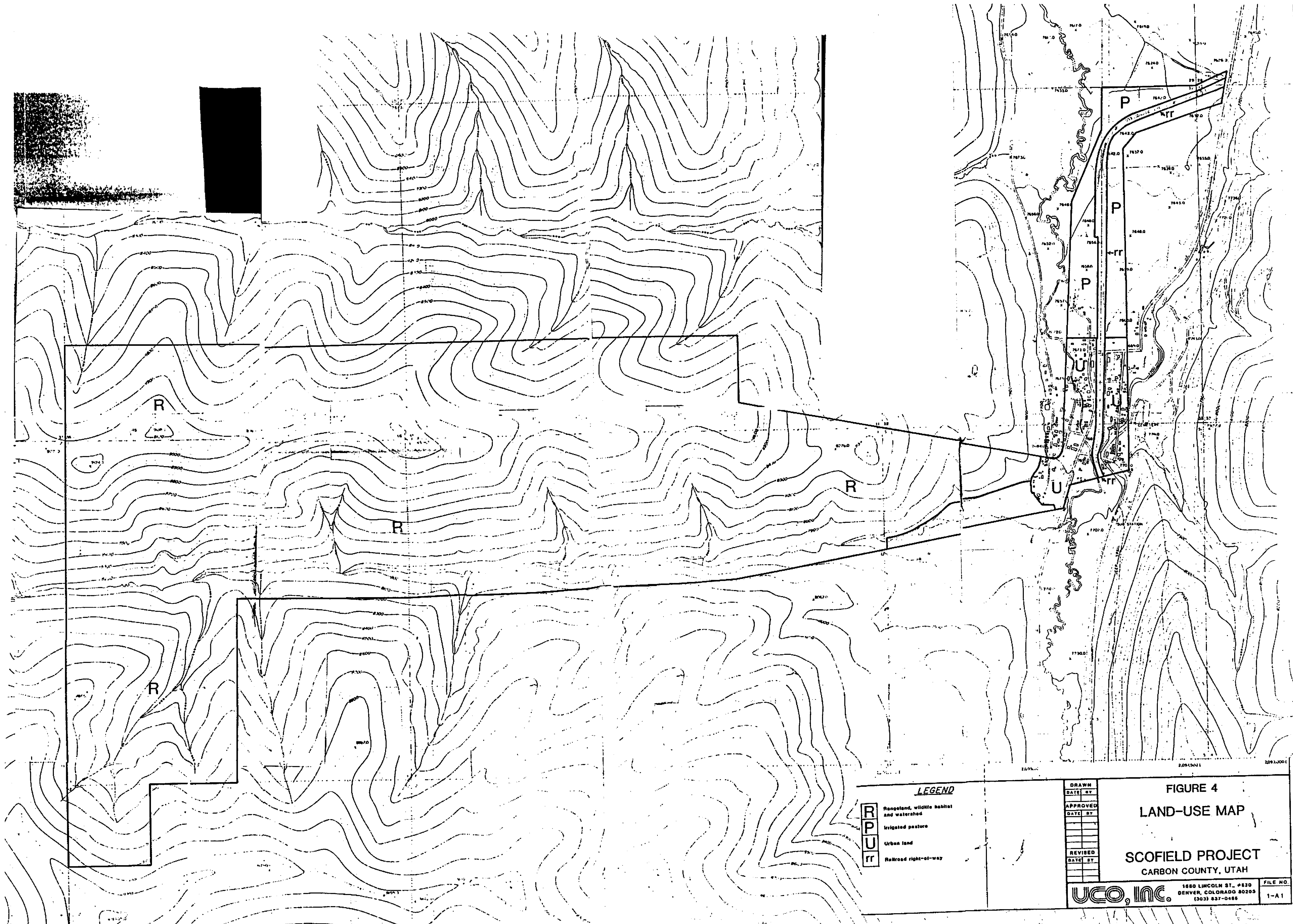
I apologize for the delay in answering your inquiry. We have preliminary field soil survey data in this area. This location is transitional from the standpoint of temperature, in meeting prime farmland standards.

After considerable study we have considered the area is not prime farmland because of the cold temperatures. The soils classify in the Cryic temperature regime.

The narrow strip extending to the northeast traverses an alluvial valley.

The soils on the traverse are very high in carbonate due to deposition of materials from springs and have low capability in production of any crops except some water loving plants.

T. B. HUTCHINGS
State Soil Scientist


R
P
U
rr
LEGEND
R Rangeland, wildlife habitat and watershed
P Irrigated pasture
U Urban land
rr Railroad right-of-way
DRAWN
DATE BY
APPROVED
DATE BY
REVISED
DATE BY
FIGURE 4
LAND-USE MAP
SCOFIELD PROJECT
CARBON COUNTY, UTAH
UCO, INC.
1660 LINCOLN ST., #630
DENVER, COLORADO 80203
(303) 837-0466
FILE NO.
1-A1

QUESTAR PIPELINE COMPANY'S
MAIN LINE NO. 41
FINAL ENVIRONMENTAL IMPACT STATEMENT
ABSTRACT, SUMMARY, AND RECORD OF DECISION, 1990

Questar Pipeline Company's Main Line No. 41 Reroute at Skyline Mine

Final Environmental Impact Statement

Abstract, Summary, and Record of Decision

Manti-La Sal National Forest

July 1990

FINAL ENVIRONMENTAL IMPACT STATEMENT

Questar Pipeline Company
Main Line No. 41 Reroute Project

Lead Federal Agency:	U.S. Department of Agriculture - Forest Service Manti-La Sal National Forest 599 West Price River Drive Price, Utah 84501
Cooperating Federal Agency:	U.S. Department of the Interior Bureau of Land Management Moab District Office 82 East Dogwood Moab, Utah 84532 Gene Nodine, District Manager
Responsible Official:	George Morris Forest Supervisor
For Further Information:	Walt Nowak, Interdisciplinary Team Leader Manti-La Sal National Forest Price District 599 West Price River Drive Price, Utah 84501 (801) 637-2817

Abstract:

Questar Pipeline Company has applied to the Forest Service for an amendment to a special use permit to allow relocation of a 4.25-mile section of a buried, 18-inch, natural-gas-transmission pipeline located on the Manti-La Sal National Forest. The existing pipeline, Main Line No. 41, which has been operating since 1953, crosses coal reserves that are proposed for mining beginning in the Fall of 1990 by Utah Fuel Company's Skyline Mine. Questar Pipeline Company is pursuing the project at the request of Utah Fuel Company to enable coal mining activities to proceed at the Skyline Mine. Relocating the pipeline would avoid potential damage and costly repairs that could be caused by the proposed coal-mining activities.

Alternatives include:

A. No Action - leave pipeline in existing location, allow only limited mining, do not allow subsidence

B. Leave pipeline in existing location, allow complete mining of reserves beneath, restore or repair subsidence-induced damage, protect against interruption of service

C. Relocate to Burnout Canyon Route

D. Relocate to Gooseberry Route

(Valley Camp Triangle Connectors - common to existing, Burnout Canyon, and Gooseberry routes)

E. Relocate to Winter Quarters Route

The Forest Service's preferred alternative is Burnout Canyon Route (3), which includes Valley Camp Triangle Connector (1) and using modifications to the route presented in the draft environmental impact statement (DEIS), in the areas of the Connellville fault, mouth of Burnout Canyon, and near The Kitchen.

ENVIRONMENTAL IMPACT STATEMENT SUMMARY

PURPOSE OF AND NEED FOR ACTION

Questar Pipeline Company (Questar Pipeline) has applied to the Forest Service for an amendment to a special use permit to allow relocation of a 4.25-mile section of a buried, 18-inch, natural-gas-transmission pipeline, Main Line No. 41, located on the Manti-La Sal National Forest. The existing pipeline, which has been operating since 1953, crosses the Skyline Mine permit area affecting 14.9 million tons of recoverable coal reserves. Utah Fuel Company (Utah Fuel), owner of the Skyline Mine, proposes to begin mining these reserves in the Fall of 1990. Questar Pipeline is pursuing an amendment at the request of Utah Fuel to enable mining activities to proceed this Fall. Relocating the pipeline would avoid potential damage and costly repairs that could be caused by the proposed coal mining activities. The pipeline serves approximately 70,000 residential and commercial customers in the region consisting of Utah Valley south to St. George.

The Forest Supervisor of the Manti-La Sal National Forest is the official responsible for deciding on Questar Pipeline's application to amend its present special use permit to allow relocation of Main Line No. 41.

Forest Service personnel reviewed Questar Pipeline's application, initiated project scoping, and identified a number of potential issues that were included in the August 1989 scoping document. The Forest Service notified the public of the proposed project through a Federal Register notice, news articles, and letters in August 1989. The initial opportunity for the public to comment on the project was at a public scoping meeting on August 30, 1989, in Price, Utah.

Resulting comments further assisted to identify the scope of issues to be addressed during the environmental analysis for this environmental impact statement (EIS). Issues identified by the Forest Service and comments from the public are summarized below.

- potential for degradation of watershed, floodplain conditions, water quality (caused by sedimentation), streambank stability, vegetation (especially riparian vegetation along Upper Huntington Creek), and visual quality

- potential effects on grazing

- potential for disruption of recreation during construction

- potential damage to, safety conflicts with public uses on, and maintenance of State Highways 264 and 96, and Skyline Drive during construction

- potential impacts to livestock, wildlife, and fish caused from construction

- potential for pipeline construction inducing land failures in unstable areas

- the inclusion of affected landowners and agencies along alternative proposed routes in the evaluation process

- minimization of conflicts between pipeline protection and coal recovery to allow maximum coal recovery from Federal lands

Valley Camp Triangle Connectors - (common to Burnout Canyon and Gooseberry routes)
(1) 1.0 mile entire connector, 0.6 mile of new pipeline
(2) 0.9 mile entire connector, 0.6 mile of new pipeline
(3) 0.5 mile entire connector, 0.5 mile of new pipeline

Alternative E - Winter Quarters Routes - (2 variations)
(1) 16.1 (20.2*) miles entire route, 12.4 miles new pipeline
(2) 17.2 (20.2*) miles entire route, 12.2 miles new pipeline
(*If either of the Alternative E routes are selected, sections of existing pipeline, not part of the routes, provide local service and could not be abandoned. Affects to resources are addressed as appropriate.)

The Forest Service's preferred alternative is Burnout Canyon Route (3), which includes Valley Camp Triangle Connector (1), using modifications to the route, presented in the DEIS, in the areas of the Connellville fault, mouth of Burnout Canyon, and near The Kitchen.

AFFECTED ENVIRONMENT

The project area is located north of Electric Lake in Sanpete, Carbon, and Emery counties in the State of Utah. The area lies at the western edge of the Wasatch Plateau, an area composed of coal-bearing strata of sandstone, siltstone, mudstone, and shale. Water is present in small perennial streams, reservoirs, and numerous springs and seeps. Soils are mostly clay loams, sandy loams, and loams located on steep hillslopes and ridges. Wet soils are present along perennial streams, marshes, springs, and seeps. Landslides and debris flows have occurred throughout the area and are primarily associated with weak clay layers, wet soil conditions, and local faults.

A number of different biological habitats are present, each with characteristic plant and animal communities. The existing and proposed routes involve crossing or paralleling riparian and associated wetland areas, important vegetation types, and habitat for big game and fish (Yellowstone cutthroat trout in Upper Huntington Creek are of particular note).

The project area is primarily rural. Land uses include agriculture (grazing), recreation, dispersed residential, and mining. There are private lands, as well as lands under the jurisdiction of the State of Utah and Forest Service (Manti-La Sal National Forest).

The overall setting of the area is pastoral and mountainous, features that are very appealing to recreation visitors. Highway 264 is proposed as a National Scenic Byway, and Skyline Drive in the western portion of the project area (along the Gooseberry Route) is a scenic backway.

Important or potentially important cultural resources along the proposed routes include a prehistoric camp site, an unused railroad track, three potentially sensitive historic localities, and four areas where there is a possibility of encountering buried Pleistocene vertebrate remains, which could be of both archaeological and paleontological importance.

impacts (services and goods) to the local economy could range from \$173,800 to \$294,800 from construction and about \$272,250 from installation of strain gauges for a total of \$567,050.

Alternative C - Burnout Canyon Routes. An estimated 14.7 mmt to 17.4 mmt of recoverable coal (\$29.4 million to \$34.8 million in Federal royalties) underlie the entire alternative routes. The length of this route varies from 14.9 to 15.3 miles depending upon the variation selected; 5.2 to 5.9 miles of new pipeline would be constructed. Construction would require approximately 40 days and probably could be completed this year. This proposed route would have little effect on current coal-mining operations. Approximately 2.6 mmt to 2.9 mmt of recoverable coal (\$5.2 million to \$5.8 million in Federal royalties) underlie the segments proposed for the new pipeline. Mining beneath a pipeline along Upper Huntington Creek and Burnout Creek, which the Burnout Canyon routes would parallel, is restricted to protect the perennial streams. The cost of construction and average reclamation is an estimated \$1,898,000 to \$3,060,200. Annual maintenance costs for the entire route would be \$26,820 to \$28,220. There would be no acquisition costs in regard to obtaining rights to the coal and surface area that would be committed to operation of the pipeline.

If a route on the east side of Highway 264 is selected, there is a potential for 10 pipeline stream crossings in Burnout and Upper Huntington Canyons, which could result in low-to-moderate impacts to wet soils from construction equipment compaction; low-to-moderate, short-term impacts to water quality from sedimentation (disturbance of banks and streambeds); and moderate-to-high impacts to the trout spawning areas. Also, adjacent riparian areas would be subject to short-term adverse impacts (until vegetation has regenerated). Existing impacts caused by unstable slopes occur along the northwestern portion of the route (existing pipeline). If a route on the west side of Highway 264 is selected, there would be, according to the Forest Service, 3 pipeline stream crossings.

Short-term moderate visual impacts would occur during construction along Highway 264, a proposed National Scenic Byway. A long-term moderate visual impact would occur where trees would be removed on the steep-sloped wall of Burnout Canyon, which is somewhat visible to travelers heading south on Highway 264. Roads would not be closed, but traffic flows would be reduced and delays would occur along Highway 264 during construction. Benefits from construction to the local economy could range from \$522,500 to \$1,235,000.

Alternative D - Gooseberry Route. The length of this route is about 16.7 miles, 12.6 miles of which would be new pipeline construction. Construction would require 80 to 90 days unless additional crews and equipment are used. The cost of construction and average reclamation is estimated at \$3,937,000 million. The route would not be entirely on Federal land and would require additional time and costs for acquisition of land. Also, there is a potential that Questar Pipeline would have to financially negotiate the rights for privately owned coal where its recovery would be impacted by the pipeline. Acquisition costs for surface rights-of-way and coal would be approximately \$4,612,800. Annual maintenance costs for the entire route would be approximately \$30,060.

An estimated 11.8 mmt of recoverable coal (approximately \$19 million in Federal royalties) underlie the entire route. Approximately 9.6 mmt of recoverable coal (\$14.6 million in Federal royalties) underlie the segments of proposed new pipeline.

An estimated 18.9 mmt to 24.7 mmt of recoverable coal (approximately $29.2 million to $42.4 million in Federal royalties) underlie the entire route and associated existing pipeline sections that could not be abandoned. Approximately 11.6 mmt to 17.4 mmt of recoverable coal ($14.6 million to $27.8 million in royalties) underlie the segments of proposed new pipeline.

New pipeline would cross Winter Quarters Creek and Mud Creek. The route would cross two riparian areas near Scofield that are already disturbed by grazing. Along the southern portion of the route, one variation (Segment 21) would parallel Mud Creek riparian areas that are in excellent condition (moderate-to-high impacts). During construction, no roads would close but traffic flows along Highway 96 would be reduced and delays of about 15 minutes could be anticipated. Construction disturbance would create moderate-to-high, short-term visual impacts to views from residences and Highway 96. High impacts would result from construction along Segment 21 where it descends the steep-sloped north ridge of Broads Canyon, openly visible from Highway 96. Also, existing impacts caused by unstable slopes occur along the northwestern portion of the route (existing pipeline). Benefits from construction to the local economy could range from $1,037,500 to $1,917,500.

PUBLIC REVIEW OF THE DEIS

Once the draft EIS (DEIS) was completed, a Notice of Availability of the DEIS was published by the Environmental Protection Agency (EPA) in the Federal Register on May 18, 1990, which initiated the 45-day public review period.

During the review period, on June 13 and 14, the Forest Service hosted an open house to discuss the DEIS, answer questions, and solicit comments on the DEIS. A news release announcing the open house was submitted to local newspapers, the Sun Advocate and Emery County Progress, and to the local radio station. Seventeen individuals attended the open house. No substantive comments were received.

A total of 89 letters were received during the review period. Generally, the comments supported the Burnout Canyon Route and emphasized the importance of the mining industry to the region.

DEPARTMENT OF AGRICULTURE
FOREST SERVICE

QUESTAR PIPELINE COMPANY
MAIN LINE NO. 41 REROUTE AT SKYLINE MINE

MANTI-LA SAL NATIONAL FOREST
CARBON, EMERY AND SANPETE COUNTIES, UTAH

RECORD OF DECISION
FINAL ENVIRONMENTAL IMPACT STATEMENT

Questar Pipeline Company (Questar Pipeline) has applied to the Forest Service for an amendment to a special use permit to allow relocation of 4.25 miles of a buried, 18-inch, natural-gas-transmission pipeline, Main Line No. 41, located on the Price District of the Manti-La Sal National Forest. The existing pipeline, which has been in place since 1953, crosses the Skyline Mine permit area affecting 14.9 million tons of recoverable coal reserves. Utah Fuel Company (Utah Fuel), owner of Skyline Mine, proposes to begin mining these reserves in 1990. Questar Pipeline is pursuing an amendment at the request of Utah Fuel to enable mining activities to proceed. Relocating the pipeline would avoid potential damage and costly repairs that could be caused by the proposed mining activities. The pipeline serves approximately 70,000 residential and commercial customers from American Fork to St. George, Utah.

Based on the analysis contain in the Final Environmental Impact Statement for Main Line No. 41 Reroute at Skyline Mine (FEIS), it is my decision to select Alternative C - Burnout Canyon Route (3) with Valley Camp Connector (1) as the best balance between known needs and potential impacts. My decision is based upon its being consistent with the standards and guidelines contained in the Manti-La Sal National Forest Land and Resource Management Plan (Forest Plan), and upon a review of environmental consequences of alternatives as disclosed in Chapter 4 of the FEIS. Particular attention was given to responsiveness of the selected alternative to issues identified in the scoping phase of the project and public comment received on the Draft Environmental Impact Statement (DEIS). Public involvement documents are contained in Appendix D of the FEIS. Public comments and Forest Service responses are contained in Chapter 6 of the FEIS.

Alternative C would amend Questar Pipeline's special use permit to allow relocation of a 4.25 mile section to a 5.9 mile route in Burnout and Upper Huntington canyons. This alternative responds to user demands, while giving consideration to critical environmental issues, user costs, and public concerns.

Environmental impacts from construction, operation, and maintenance of the selected alternative will be kept within the acceptable levels established by laws, regulations, and the Forest Plan. Questar Pipeline will adhere to the stipulations contained in Attachment A of Appendix A of the FEIS. All practical means to avoid or minimize environmental harm resulting from implementation of the selected alternative have been adopted.

Burnout Canyon Route (4) - This alternative route was very close in preference to the selected route but was not chosen because it had more impacts to recoverable coal, riparian resources and would have 2 additional intermittent stream crossings.

Alternative D - Gooseberry Route

This alternative would allow for relocating the pipeline in Burnout Canyon, Upper Huntington Canyon, Swens Canyon, and Gooseberry drainages. Utah Fuels would mine the same amount of coal under this alternative as Alternative C - Burnout Canyon Routes (1) and (2).

This alternative was somewhat close in preference to the selected alternative route but was not chosen because it would have higher riparian and spawning/fisheries habitat impacts, twice the stream crossings and cost $5.5 million more than the selected alternative route. New construction on this route is the longest and would affect more unstable slopes than any other relocation routes.

Valley Camp Triangle Connectors (common to Burnout Canyon & Gooseberry Routes)

Analysis in the FEIS shows that all 3 connectors have little total difference between them. Connector (1) was selected because, after mitigation, it would have the least affect on wet, unstable slopes and recoverable coal resources. It would cost the least to construct.

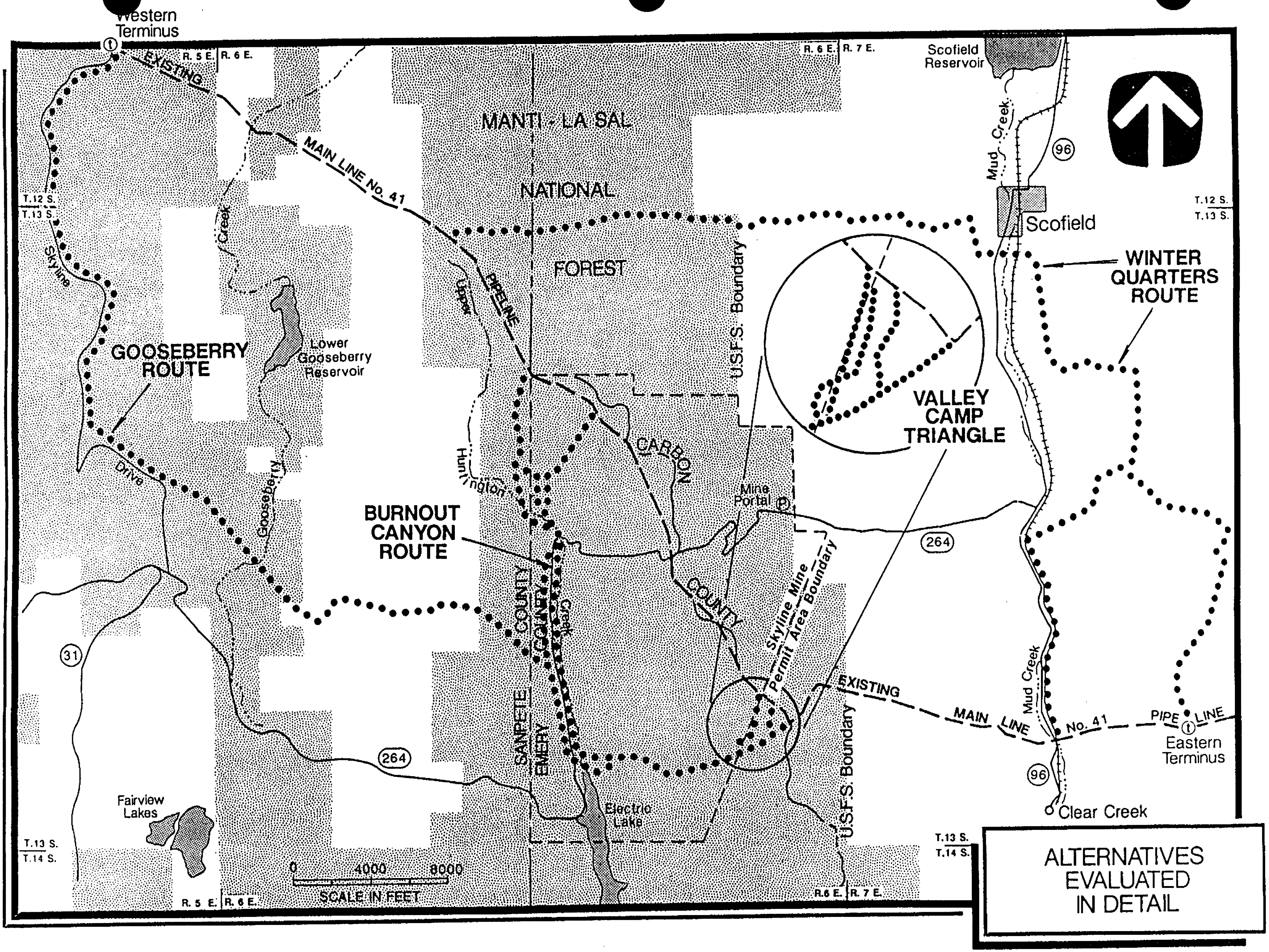
Alternative E - Winter Quarters Routes (1),(2)

This alternative would allow the relocation of the pipeline in the Pleasant Valley and Winter Quarters drainages. The length of these routes would be primarily on private lands off National Forest System lands.

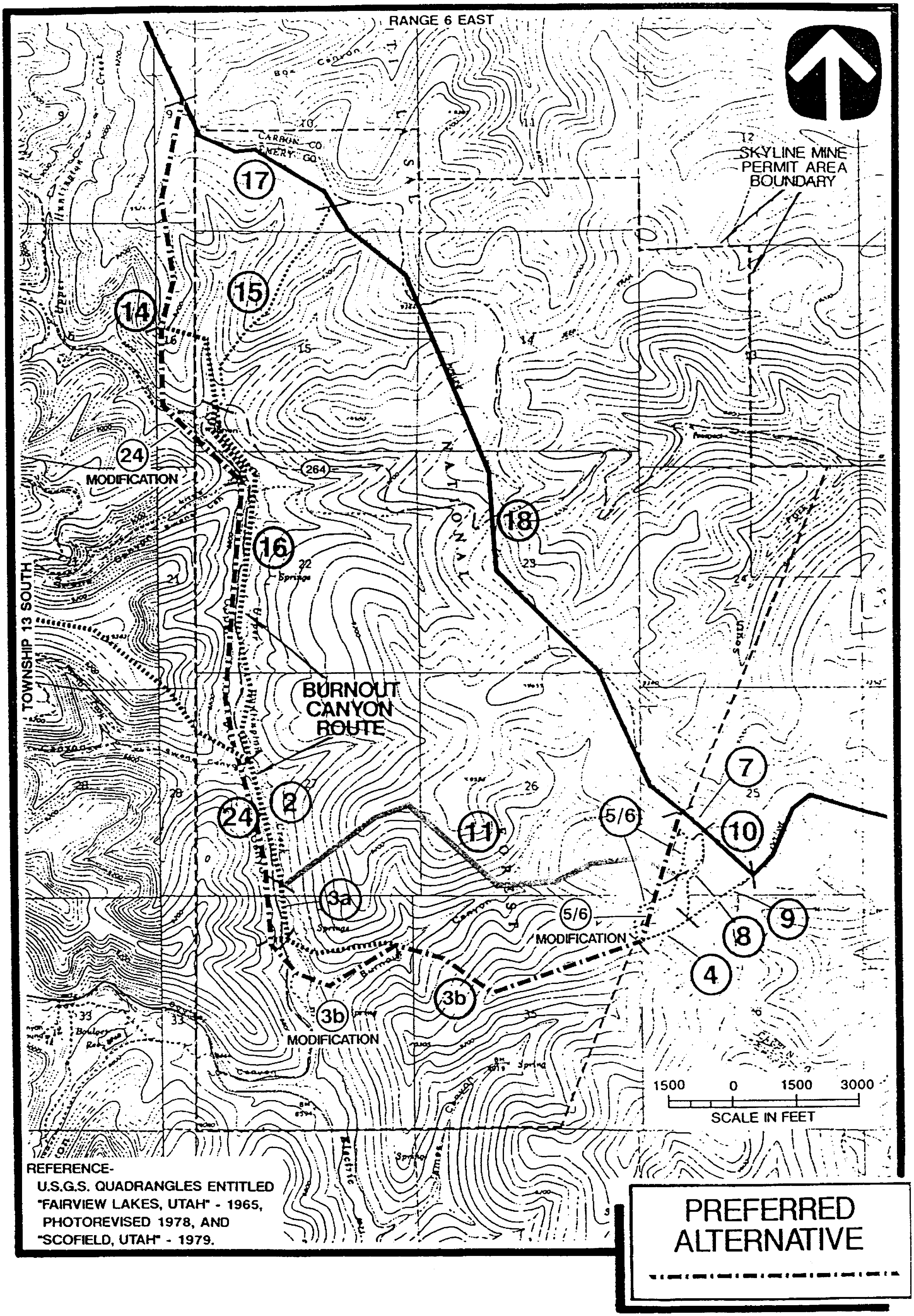
Winter Quarters (1) - This alternative route was not selected because new pipeline construction would preclude the mining of the greatest amount of recoverable coal reserves and cost more than any other route. It would also have a low probability of being completed this year and could affect an additional 3 to 9 million tons of recoverable coal. This is the longest route of all.

Winter Quarter (2) - This alternative route was not chosen because, compared to the selected alternative, it is more than twice as long, would affect 9 more million tons of recoverable coal, would have 2 more perennial stream crossings, and would cost 3 times more. It also has a low probability of being completed this year and could affect an additional 3 to 9 million tons of recoverable coal.

The issues discussed in the alternatives formed the basis for the decision. The issues varied in importance and value, and in some instances, the differences in advantages were so small they were insignificant in the selection process. No single issue determined selection. Rather, all environmental, social and economic factors were blended to best resolve the identified issues and to select an alternative.


Western Terminus
EXISTING
MAIN LINE No. 41
PIPELINE
MANTI - LA SAL
NATIONAL
FOREST
Scofield Reservoir
Scofield
Mud Creek
96
WINTER QUARTERS ROUTE
GOOSEBERRY ROUTE
Lower Gooseberry Reservoir
Gooseberry
Creek
Skyline
Drive
Upper
Huntington
BURNOUT CANYON ROUTE
VALLEY CAMP TRIANGLE
CARBON
COUNTY
SANPETE COUNTY
EMERY COUNTY
Creek
Mine Portal
U.S.F.S. Boundary
Skyline Mine Permit Area Boundary
264
EXISTING MAIN LINE No. 41 PIPE LINE
Eastern Terminus
Clear Creek
31
Fairview Lakes
Electric Lake
0 4000 8000
SCALE IN FEET
R. 5 E. R. 6 E.
R. 6 E. R. 7 E.
T. 12 S.
T. 13 S.
T. 14 S.
ALTERNATIVES EVALUATED IN DETAIL

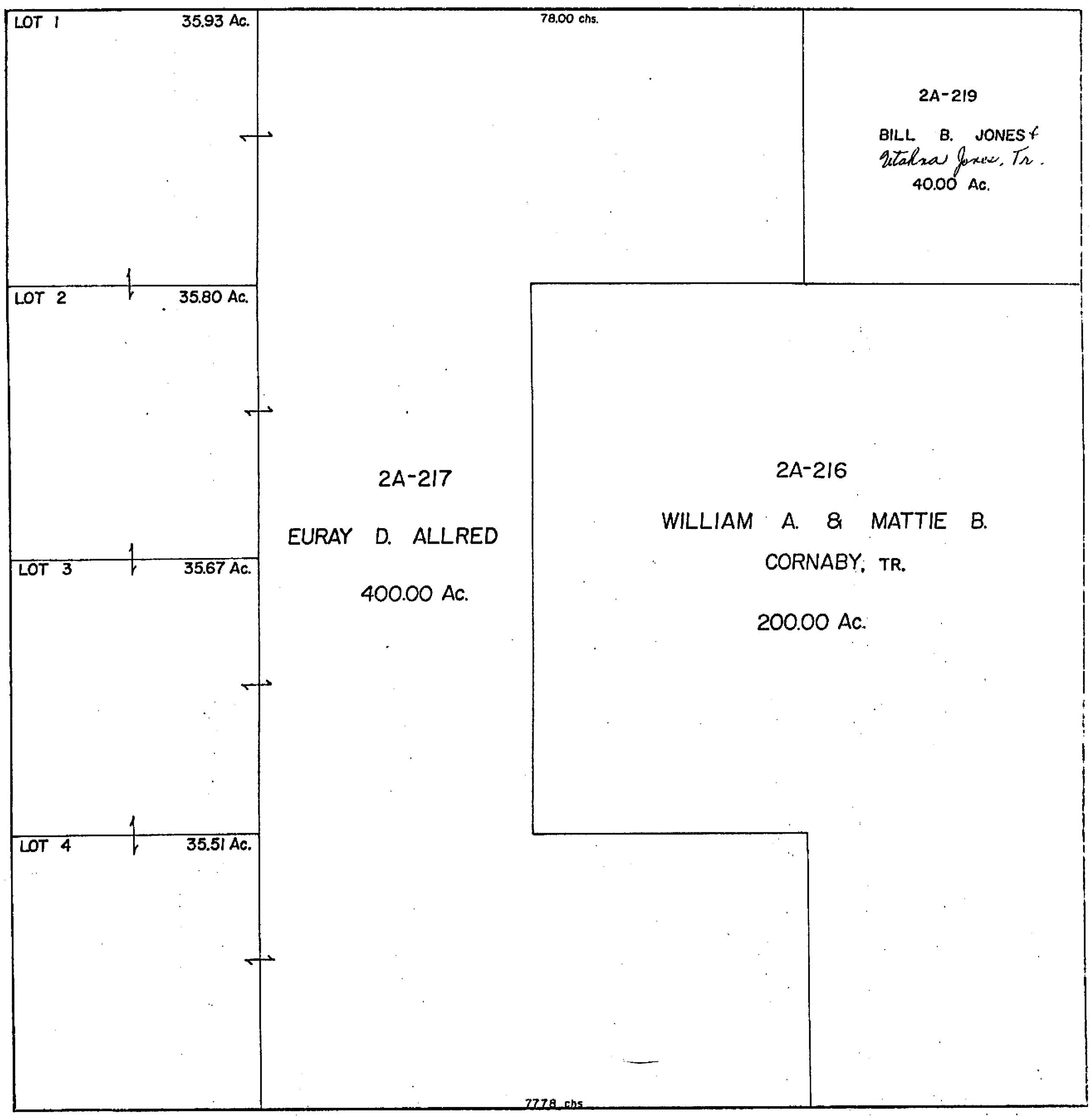
MAP 1


RANGE 6 EAST
TOWNSHIP 13 SOUTH
SKYLINE MINE PERMIT AREA BOUNDARY
CARBON CO
EMERY CO
17
15
14
24
MODIFICATION
264
16
18
BURNOUT CANYON ROUTE
24
2
11
5/6
7
10
3a
5/6
MODIFICATION
9
8
4
3b
3b
MODIFICATION
1500 0 1500 3000
SCALE IN FEET
REFERENCE-
U.S.G.S. QUADRANGLES ENTITLED "FAIRVIEW LAKES, UTAH" - 1965, PHOTOREVISED 1978, AND "SCOFIELD, UTAH" - 1979.
PREFERRED ALTERNATIVE

CARBON COUNTY PLATS AND CONSOLIDATED COAL COMPANY LAND OWNERSHIP PLATE

CARBON COUNTY PLATS

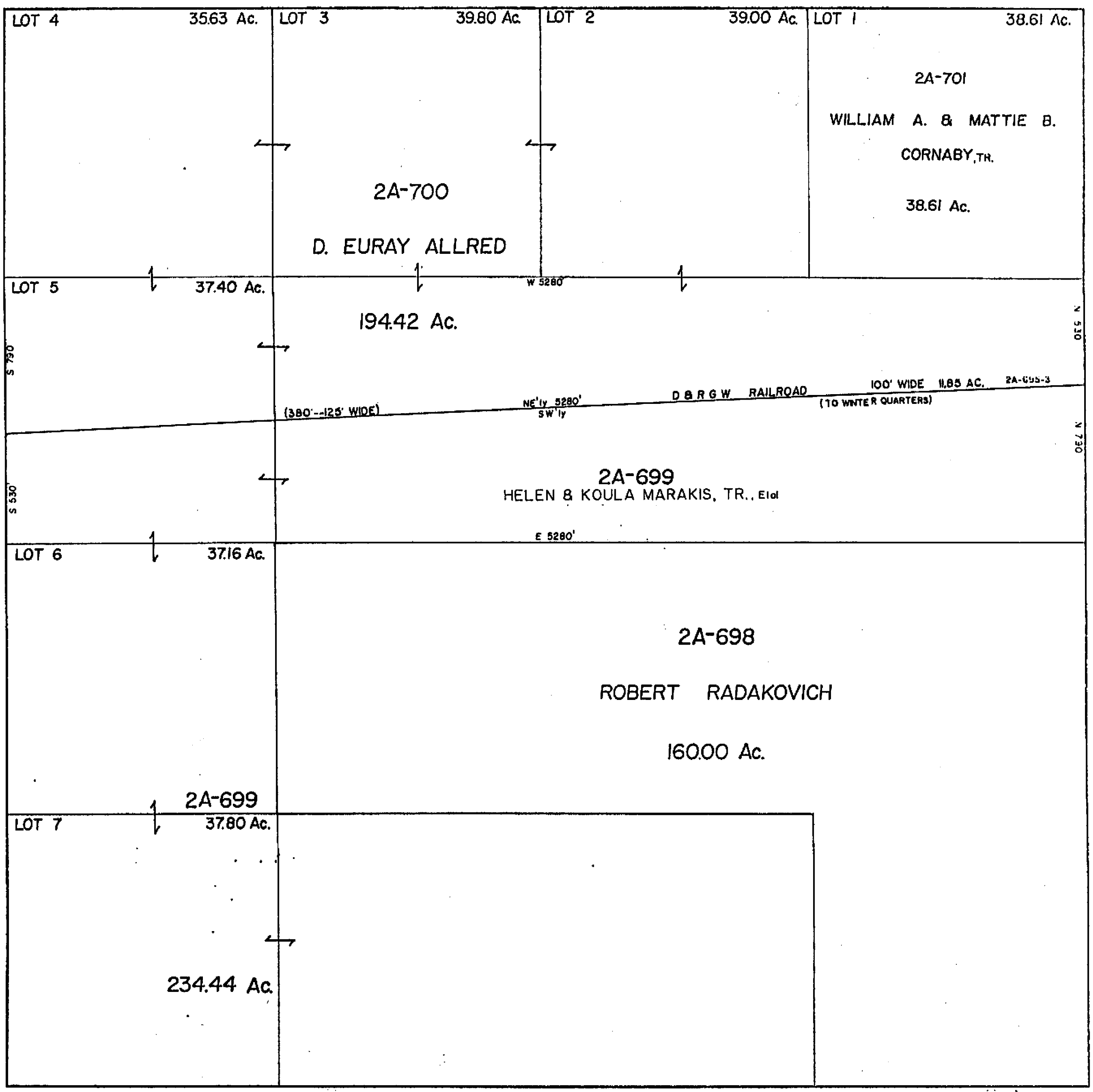
SECTION 31 TOWNSHIP 12 SOUTH, RANGE 7 EAST



Scale 400 feet–1 inch

CARBON COUNTY PLATS

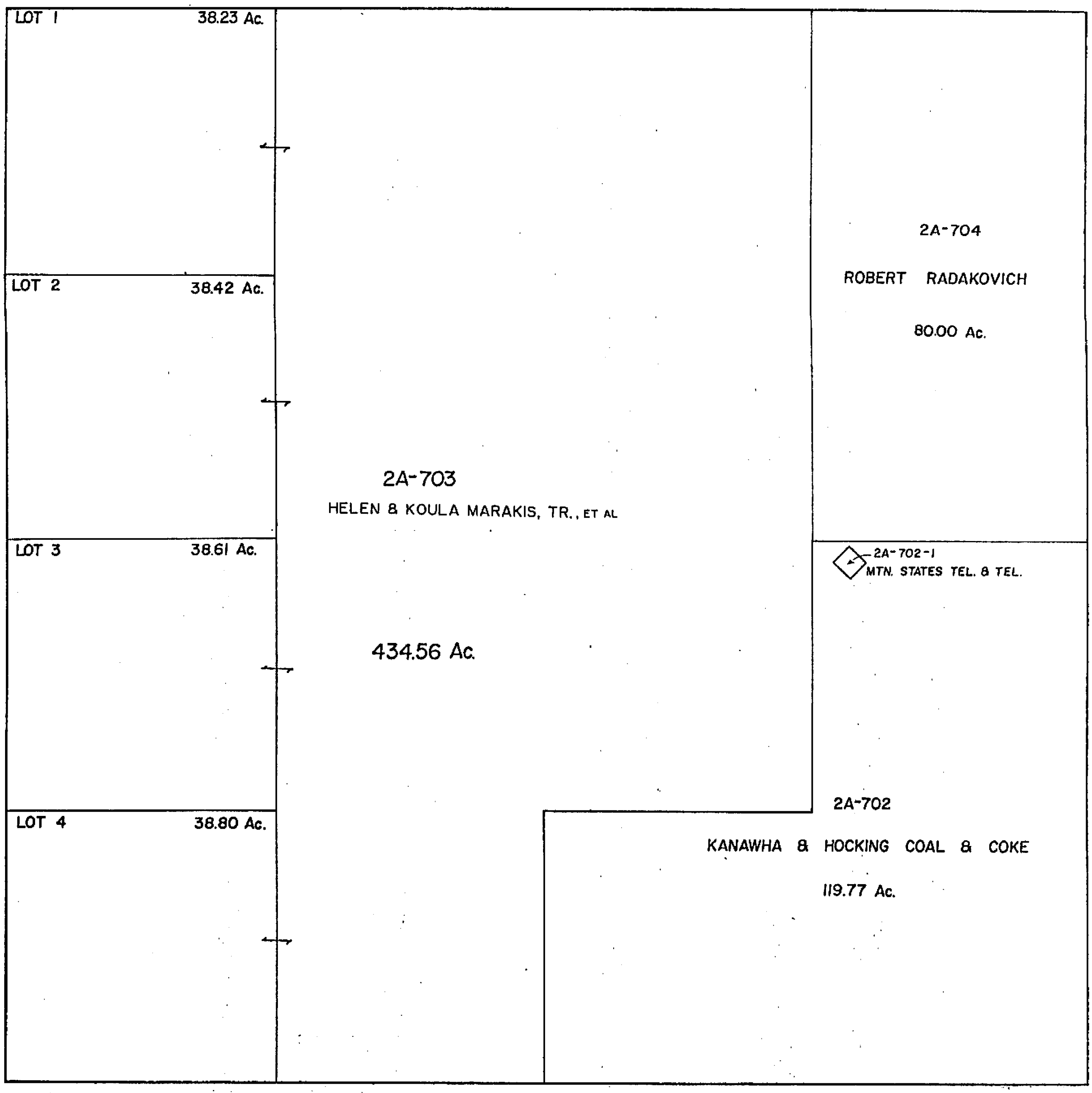
SECTION 6 TOWNSHIP 13 SOUTH, RANGE 7 EAST



Scale 400 feet–1 inch

CARBON COUNTY PLATS

SECTION 7 TOWNSHIP 13 SOUTH, RANGE 7 EAST



Scale 400 feet–1 inch

CARBON COUNTY PLATS

SECTION 36 TOWNSHIP 12 SOUTH, RANGE 7 EAST

2A- 231

ARTHUR J. ANDERSON, et al

640 Ac.

Scale 400 feet–1 inch

CARBON COUNTY PLATS

SECTION 1 TOWNSHIP 13 SOUTH, RANGE 7 EAST

LOT 4 37.48 Ac.	LOT 3 37.42 Ac.	LOT 2 37.38 Ac.	LOT 1 37.32 Ac.

2A-688

HELPER ASSOCIATES

629.60 Ac.

Scale 400 feet–1 inch

CARBON COUNTY PLATS

SECTION 12 TOWNSHIP 13 SOUTH, RANGE 7 EAST

2A-719

HELPER ASSOCIATES

640.00 Ac.

Scale 400 feet–1 inch

APPENDIX I

SOCIOECONOMICS

APPENDIX I
SOCIOECONOMICS

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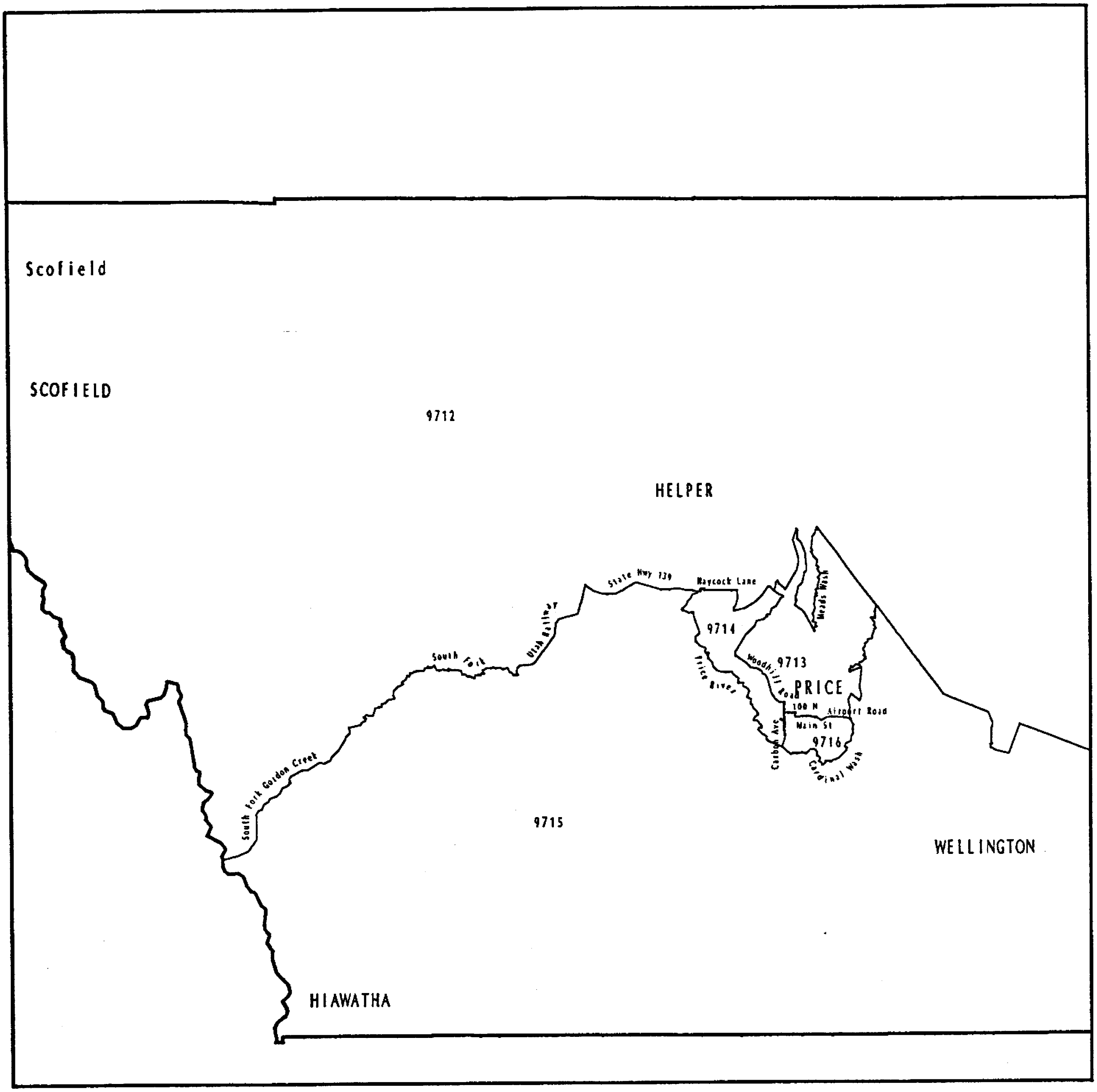
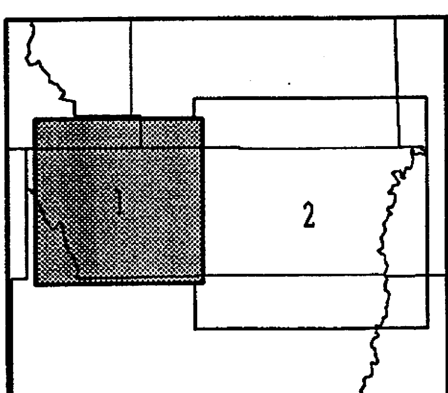
CENSUS OF POPULATION & HOUSING
CARBON COUNTY
OFFICE OF PLANNING & BUDGET





Carbon County

Source: Utah State Geographic Information Database
Processed from: TIGER/Line Census Files, 1990 /
Bureau of the Census. -Washington

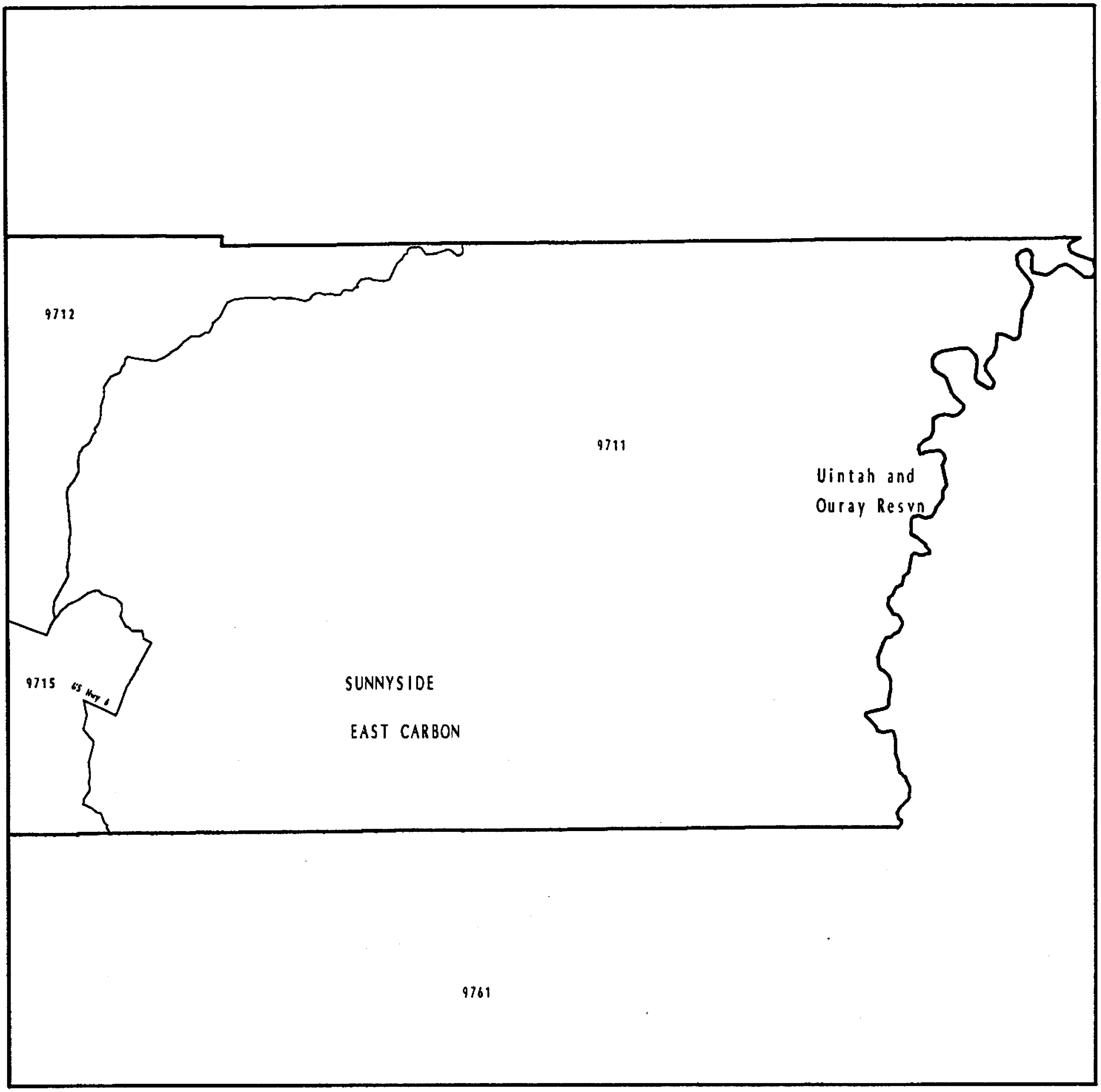
State of Utah
Office of Planning and Budget
Demographic and Economic Analysis
116 State Capitol
Salt Lake City, UT 84114
(801) 538-1036

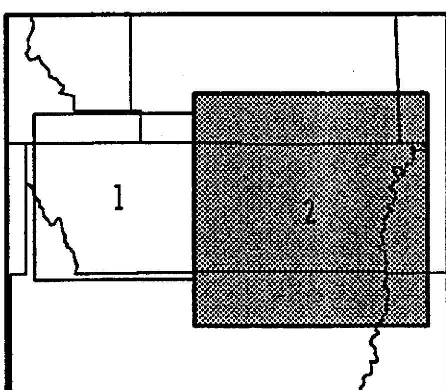
map sheet: carb1

Census Tracts

Map design: Utah Automated Geographic Reference Center

03/26/92





Carbon County

Source: Utah State Geographic Information Database
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Bureau of the Census. -Washington

State of Utah
Office of Planning and Budget
Demographic and Economic Analysis
116 State Capitol
Salt Lake City, UT 84114
(801) 538-1036

map sheet: carb2

Census Tracts

Map design: Utah Automated Geographic Reference Center

03/26/92

P.L. 94-171 FILE, 1990 CENSUS OF POPULATION AND HOUSING

Counts of Housing Units and Population
by County and Tract/BNA for Utah

Cnty Code	Area	Housing Units	Total Population
001	Beaver County	2,200	4,765
001	BNA 9811	1,310	2,676
001	BNA 9812	890	2,089
003	Box Elder County	11,890	36,485
003	BNA 9601	915	2,443
003	BNA 9602	1,628	5,381
003	BNA 9603	1,579	4,818
003	BNA 9604	1,206	3,975
003	BNA 9605	1,380	3,928
003	BNA 9606	1,982	6,288
003	BNA 9607	1,910	5,680
003	BNA 9608	1,290	3,972
005	Cache County	22,053	70,183
005	Tract 1	1,532	5,017
005	Tract 2	1,695	6,005
005	Tract 3	860	2,951
005	Tract 4	1,736	6,645
005	Tract 5	1,915	5,173
005	Tract 6	1,743	4,973
005	Tract 7	2,017	7,392
005	Tract 8	2,115	4,633
005	Tract 9	1,301	3,495
005	Tract 10	1,687	4,792
005	Tract 11	1,465	5,089
005	Tract 12	1,110	4,262
005	Tract 13	1,015	3,476
005	Tract 14	1,341	5,002
005	Tract 15	364	1,266
005	Tract 16	157	12
005	Tract 17.96	0	0
005	Tract 17.97	0	0
005	Tract 17.98	0	0
007	Carbon County	8,713	20,228
007	BNA 9711	947	1,628
007	BNA 9712	2,066	3,516
007	BNA 9713	1,849	5,265
007	BNA 9714	1,159	2,711

Counts of Housing Units and Population
by County and Tract/BNA for Utah

Cnty Code	Area	Housing Units	Total Population
007	BNA 9715	1,672	4,827
007	BNA 9716	1,020	2,281
009	Daggett County	825	690
009	BNA 9901	825	690
011	Davis County	55,777	187,941
011	Tract 1251.01	1,314	5,066
011	Tract 1251.02	845	3,047
011	Tract 1252	1,175	5,266
011	Tract 1253.01	1,768	5,116
011	Tract 1253.02	2,157	8,407
011	Tract 1254.01	875	3,351
011	Tract 1254.02	1,333	5,065
011	Tract 1255	2,957	10,216
011	Tract 1256	20	1,488
011	Tract 1257	2,342	6,075
011	Tract 1258.01	1,802	5,771
0'1	Tract 1258.02	4,130	9,242
011	Tract 1258.04	1,272	4,945
011	Tract 1259.03	2,623	8,671
011	Tract 1259.04	1,444	5,141
011	Tract 1260	2,212	6,993
011	Tract 1261.01	1,600	5,572
011	Tract 1261.02	1,541	5,558
011	Tract 1261.03	1,031	4,205
011	Tract 1261.04	231	913
011	Tract 1262.01	1,750	6,959
011	Tract 1262.02	373	1,453
011	Tract 1263	7	30
011	Tract 1263.01	1,671	7,390
011	Tract 1263.02	1,992	6,578
011	Tract 1264.01	2,639	8,763
011	Tract 1264.02	527	2,115
011	Tract 1265	1,803	6,492
011	Tract 1266	1,648	4,574
011	Tract 1267	1,453	3,733
011	Tract 1268.01	967	3,298
011	Tract 1268.02	1,478	5,555
011	Tract 1269.01	2,115	5,783

SOCIOECONOMIC ASSESSMENT
UCO, INC. ,1982

GROUND COAL MINING PERMIT APPLICATION

SCOFIELD MINE

CARBON COUNTY, UTAH

UCO, Inc.
7355 E. Orchard Rd.
Suite 100
Englewood, Colorado 80111

September, 1982

CHAPTER XI

SOCIOECONOMIC ASSESSMENT

UC-435-301

A SOCIOECONOMIC ASSESSMENT OF

THE SCOFIELD PROJECT

CARBON COUNTY, UTAH

Prepared for
UCO, Inc.
7355 East Orchard
Englewood, Colorado 80111
(303) 773-2397
J. Chris Carter, Vice President of Governmental Affairs

By
Ford, Bacon & Davis Utah Inc.
375 Chipeta Way
Salt Lake City, Utah 84108
(801) 583-3773, Ext. 234

September 1982

OVERVIEW

The Scofield Project will employ 75 people at peak construction, and 110 at peak operation. Peak construction is projected to occur in 1983, with peak operations in 1985.

Currently, Carbon County is experiencing a high unemployment rate of 9.2 percent. This figure does not reflect the recent lay-offs in the coal industry. In July 1982, 105 experienced coal miners and 124 inexperienced miners were seeking employment in the Carbon County coal mines. Thus, a sufficient workforce is in place to staff the project. Some professional and managerial employees probably will come from outside Carbon County.

Miners will be bused to the Scofield Project, with the bus route originating in the Price-Helper area. The bus system will alleviate the annual daily traffic in and around Scofield Reservoir, and will minimize the potential for miners to move to Scofield town where few permanent amenities exist.

The population impact created by UCO, Inc. for both direct and indirect job slots is forecast to be 78 people, 23 of whom will be children. The positive financial impact to Carbon County will be over $4 million annually when peak operations are met.

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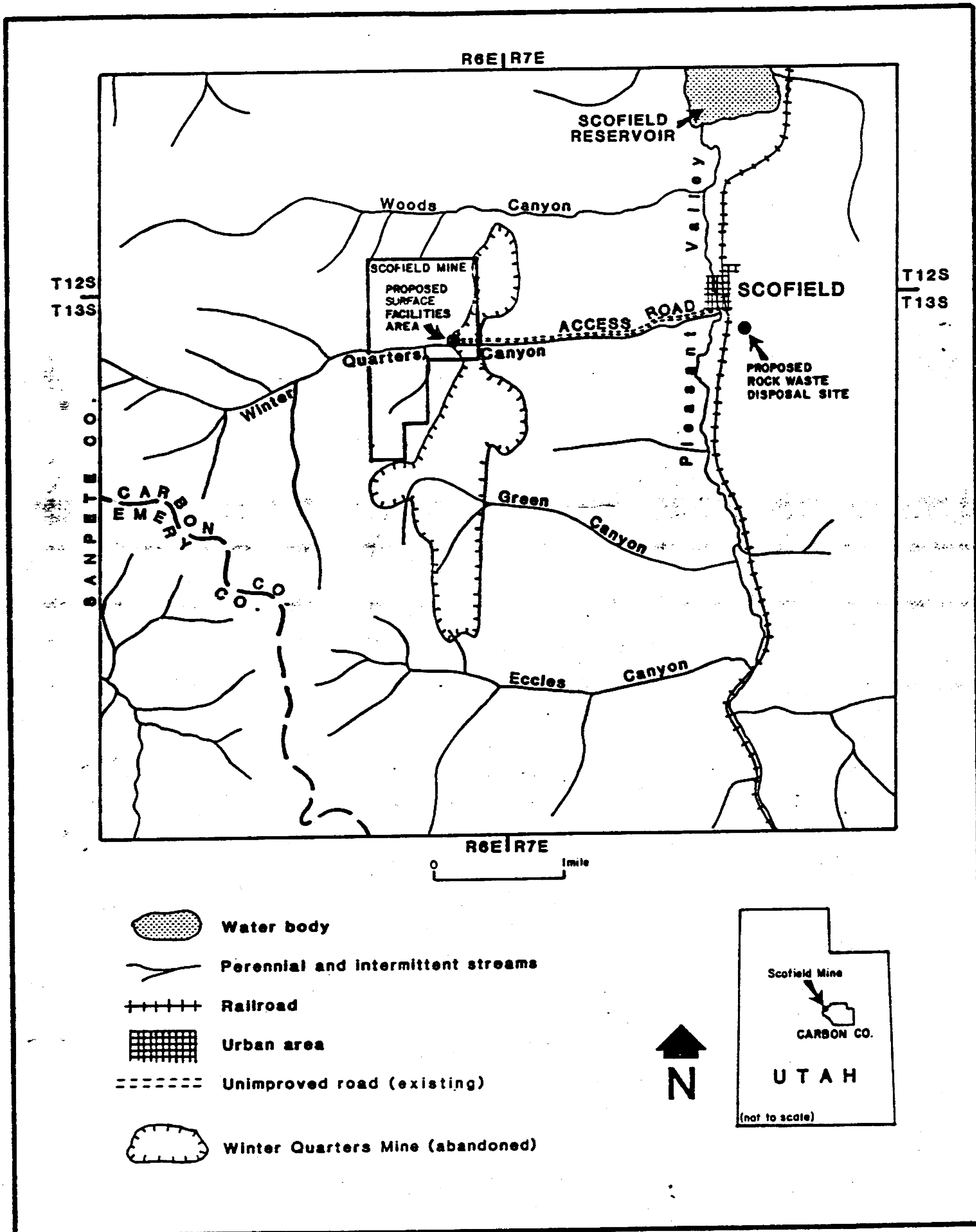
I. INTRODUCTION

A. BACKGROUND

UCO, Inc. intends to develop the Scofield Project, which consists of a 700,000-tons-per-year underground coal mine (the Scofield Mine) in Carbon County, Utah, and an attendant unit-train coal load-out facility. The coal from the Scofield Mine is a high-BTU, low-sulfur fuel. The mine is in Winter Quarters Canyon, 1.5 miles west of Scofield, Utah. The rail load-out facility will be located 2.5 miles northeast of Scofield, at the mouth of Miller Canyon (see Figure 1). The coal will be contract-trucked 4 miles from the mine to a rail loadout facility.

A significant portion of the Scofield Mine coal is intended for export to Japan. Through Nichimen Company of Tokyo, UCO's agent for coal export to Japan, a purchase order has been executed with the Nippon Kokan Steel Company. The contract calls for 100,000 tons of coal from first year production to be exported to Japan, and a minimum of 200,000 tons annually thereafter through 1987.

The Scofield Mine will be operated on a Carbon County leasehold interest owned by UCO, Inc. From 1977 to 1979, Carbon County received $1,200 annually, or a total of $3,600 from the undeveloped property. From 1980 through 1982, the county received $25,000 annually, or $75,000 from the lease. Once coal production begins, Carbon County will receive royalty payments equivalent to $0.15/ton for the coal mined on county property,



SCOFIELD MINE PROJECT AREA

FIGURE 1

or approximately $31,500 annually through 1986, when UCO will renegotiate the lease with Carbon County.

This socioeconomic assessment of the Scofield Project is being completed to comply with two laws. The first law is Carbon County Ordinance 155, Article V, Section 5.4, entitled Major Underground and Surface Mine Development. This law requires a socioeconomic assessment of a mine that employs more than 75 workers at peak production or construction. Approximately 110 workers will be employed by UCO at peak operation. The second legal requirement is found in the Utah Code Annotated, 63-51-1-10. This state statute requires filing of a mitigation plan with the Department of Community and Economic Development (DCED) before construction begins, if the project is to employ more than 500 people or to create a 5-percent population increase in any unit of local government. The government unit that could be affected is the town of Scofield. Should any project workers decide to reside in Scofield, UCO will develop mitigation measures to minimize the socioeconomic impact on Scofield due to the development of the Scofield mine.

The discussion in this report of the socioeconomic impacts is based on two diverse assumptions. One assumption, relative to the short term, is that UCO will create a net positive impact on Carbon County by hiring currently unemployed workers. This will help to alleviate the currently depressed coal miner employment market. A second assumption is that the coal market could be rejuvenated, in which case the existing coal mines then would rehire currently unemployed miners. Both scenarios are considered in Chapter IV of this report.

B. PROJECT-SPECIFIC INFORMATION

The production and employment levels along with the critical dates utilized in this assessment are as follows:

TABLE 1

SCHEDULE

Time Frame and Task			Employees
May 1983	-	Begin construction	75
December 1983	-	Produce 70,000 tons	50
December 1984	-	Produce 398,000 tons	78
December 1985	-	Produce 700,000 tons	110
1986	-	Renegotiate lease with Carbon County	
1988	-	Repermit through Division of Oil, Gas & Mining	

Source: UCO communication with FB&DU, July 1982.

As shown in Table 1, local and state officials have an opportunity to continually monitor the impacts of the Scofield Project. The importance of emphasizing the future decision points noted in Table 1 is to stress that if the coal market does improve in the next 2 to 3 years, then this socioeconomic impact assessment can be modified to reflect changes in the overall economic conditions of the coal industry and Carbon County.

A critical determination in a socioeconomic assessment is to configure the likely in-migration and settlement patterns of the work force. To determine if the local labor office could supply the 110 peak operation personnel necessary, the Job Service office in Price, Utah was contacted. This office completed manual and computer searches of the mining job applications on file on July 20, 1982 (prior to the Consolidation Coal and Valley Camp layoffs). The search broke down the applications into experienced and inexperienced categories. Table 2 data show that 105 experienced miners from Carbon County are currently seeking employment. Table 3 data show that 124 Carbon County workers with no coal mining experience are seeking jobs in the coal industry. Combined, 229 people from Carbon County are actively looking for employment in the coal industry (see Figure 2). Consequently, there appears to be a sufficient labor supply available to fill the peak 110 jobs projected for the Scofield Project.

As a further check, a job-match analysis was performed to determine if this apparent over-supply of workers was accurate; that is, the analysis objective was to decide if the occupational skill levels needed by UCO matched the occupational experience of the available labor force. Table 4 lists the UCO peak demand by occupational skills and compares them to the Carbon County labor force available for those skills. The final column in Table 4 indicates where the occupational skills requirements cannot be met; from these data, the numbers of workers to be obtained through in-migration then were computed.

TABLE 2

EXPERIENCED MINERS

CARBON COUNTY	**105**
Price	66
Helper	17
East Carbon	7
Wellington	9
Kenilworth	4
Sunnyside	1
Hiawatha	1
UTAH COUNTY	**17**
Provo	1
Goshen	2
Payson	3
Springville	3
Orem	1
Spanish Fork	2
Elberta	1
Santaquin	2
Pleasant Grove	1
Salem	1
WASATCH COUNTY	**1**
Heber City	1
TOOELE COUNTY	**9**
Tooele	9
EMERY COUNTY	**50**
Ferron	5
Emery	1
Huntington	18
Clawson	2
Orangeville	6
Castle Dale	14
Cleveland	2
Green River	2
GRAND COUNTY	**12**
Moab	12
JUAB COUNTY	**3**
Eureka	2
Nephi	1
WAYNE COUNTY	**2**
Hanksville	2
SEVIER COUNTY	**1**
Salina	1
SALT LAKE COUNTY	**27**
Salt Lake City	11
West Valley	2
Kearns	8
West Jordan	2
Draper	1
Murray	1
Midvale	1
Magna	1
SAN JUAN COUNTY	**4**
Monticello	2
Blanding	2
SANPETE COUNTY	**4**
Centerfield	1
Mt. Pleasant	1
Fountain Green	1
Ephraim	1
DAVIS COUNTY	**1**
Layton	1

Source: Job Service, Price, Utah, July 20, 1982.

TABLE 3

INEXPERIENCED MINERS

CARBON COUNTY	**124**
Price	83
Wellington	8
Hiawatha	2
Helper	14
Sunnyside	10
East Carbon City	6
Kenilworth	1
GRAND COUNTY	**3**
Moab	3
IRON COUNTY	**3**
Parowan	1
Cedar City	2
JUAB COUNTY	**3**
Nephi	3
WASATCH COUNTY	**2**
Heber City	2
EMERY COUNTY	**86**
Ferron	9
Green River	2
Emery	1
Huntington	38
Castle Dale	20
Cleveland	4
Orangeville	8
Elmo	3
Clawson	1
UTAH COUNTY	**101**
American Fork	4
Provo	7
Orem	21
Spanish Fork	19
Lehi	1
Springville	10
Pleasant Grove	11
Santaquin	1
Alpine	6
Payson	9
Lindon	1
Salem	1
WAYNE COUNTY	**1**
Freemont	1
SEVIER COUNTY	**7**
Redmond	1
Salina	1
Richfield	3
Monroe	2
MILLARD COUNTY	**1**
Lynndyl	1
DUCHESNE COUNTY	**1**
Mountain Home	1
KANE COUNTY	**1**
Kanab	1
BOX ELDER COUNTY	**1**
Honeyville	1
SALT LAKE COUNTY	**65**
Holladay	2
West Jordan	7
Magna	5
West Valley City	15
Riverton	3
Sandy	5
Salt Lake City	18
Murray	4
Kearns	1
Draper	2
Midvale	3
SUMMIT COUNTY	**2**
Park City	1
Peoa	1
DAVIS COUNTY	**7**
Bountiful	4
Layton	2
Woods Cross	1
UNITAH COUNTY	**1**
Randlett	1
WEBER COUNTY	**4**
Ogden	2
Roy	2
SANPETE COUNTY	**8**
Manti	1
Fairview	1
Moroni	2
Mt. Pleasant	4

Source: Job Service, Price, Utah, July 20, 1982.

TABLE 3

INEXPERIENCED MINERS

CARBON COUNTY	**124**
Price	83
Wellington	8
Hiawatha	2
Helper	14
Sunnyside	10
East Carbon City	6
Kenilworth	1
GRAND COUNTY	**3**
Moab	3
IRON COUNTY	**3**
Parowan	1
Cedar City	2
JUAB COUNTY	**3**
Nephi	3
WASATCH COUNTY	**2**
Heber City	2
EMERY COUNTY	**86**
Ferron	9
Green River	2
Emery	1
Huntington	38
Castle Dale	20
Cleveland	4
Orangeville	8
Elmo	3
Clawson	1
UTAH COUNTY	**101**
American Fork	4
Provo	7
Orem	21
Spanish Fork	19
Lehi	1
Springville	10
Pleasant Grove	11
Santaquin	1
Alpine	6
Payson	9
Lindon	1
Salem	1
WAYNE COUNTY	**1**
Freemont	1
SEVIER COUNTY	**7**
Redmond	1
Salina	1
Richfield	3
Monroe	2
MILLARD COUNTY	**1**
Lynndyl	1
DUCHESNE COUNTY	**1**
Mountain Home	1
KANE COUNTY	**1**
Kanab	1
BOX ELDER COUNTY	**1**
Honeyville	1
SALT LAKE COUNTY	**65**
Holladay	2
West Jordan	7
Magna	5
West Valley City	15
Riverton	3
Sandy	5
Salt Lake City	18
Murray	4
Kearns	1
Draper	2
Midvale	3
SUMMIT COUNTY	**2**
Park City	1
Peoa	1
DAVIS COUNTY	**7**
Bountiful	4
Layton	2
Woods Cross	1
UNITAH COUNTY	**1**
Randlett	1
WEBER COUNTY	**4**
Ogden	2
Roy	2
SANPETE COUNTY	**8**
Manti	1
Fairview	1
Moroni	2
Mt. Pleasant	4

Source: Job Service, Price, Utah, July 20, 1982.

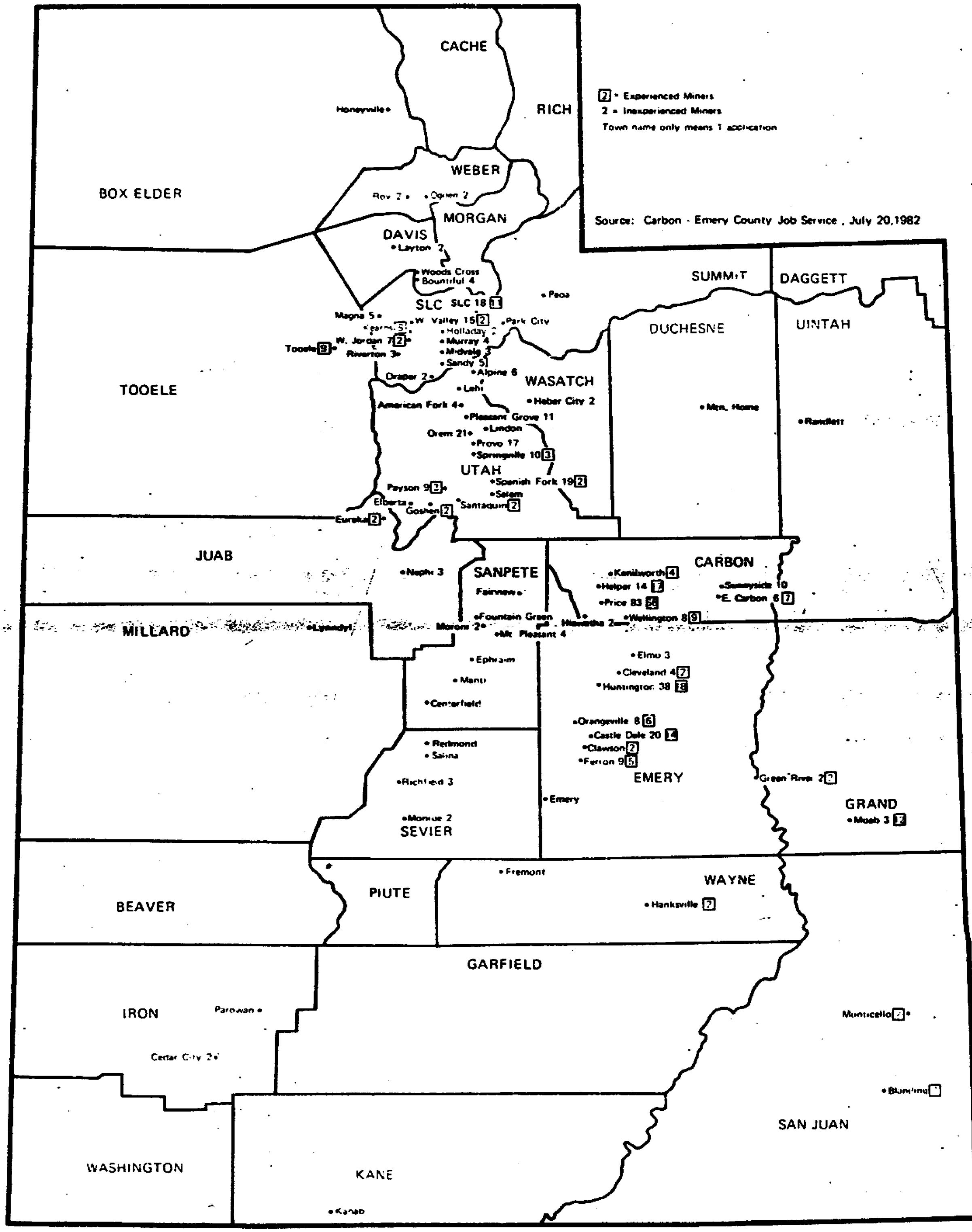


Figure 2. Number of miners seeking work in the coal mines

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TABLE 4

OCCUPATIONAL SUPPLY AND DEMAND MIX

E/I[a]	Occupation[b]	UCO Peak Demand[b]	1982 Carbon County Supply[c]	In-Migration Necessary
E	General Manager	1	0	1
E	Mine Superintendent	1	0	1
E	Mine Foreman	1	0	1
E	Shift Foreman	2	3	
E	Section Foreman	6	8	
E	Gen Maint Foreman	1	1	
E	Asst Maint Foreman	2		2
E	Electrical Foreman	1		1
E	Belt Foreman	1	1	
E	Miner Operator	4	5	
I	Miner Helper	4	Table 2	
E	Teletram Operator	8	17	
E	Roof Bolter	4	13	
I	Bolt Helper	4	Table 2 or 3	
I	Utility Man	4	Table 2 or 3	
E	Mechanic	4	6	
E	Drill Crew	2	From Table 2	
I	Supply Man	4	From Table 3	
I	Rock Duster	2	From Table 3	
I	Bratticeman	2	From Table 2	
I	Pumper/Pipeman	1	From Table 2	
I	Belt-set up	4	1	
I	Belt-cleanup	2	From Table 3	
E	Fire Boss	1	3	
E	General Labor	18	30	
E	General Mechanic	4	3	1
I	Men for Training	3[d]		
I	Truck Loadout	2	From Table 2	
E	Utility Man	2	From Table 3	
I	Tippleman	2	From Table 2	
I	Lampman	1	From Table 2	
E	Shop Mechanic	2	1	1
E	Electrician		2	
E	Safety/Environmental Engineer	1		1
E	Surveyor/Draftsman	2	Available	
E	Mine Engineer	1		1
E/I	Office Personnel	5	Available	

[a] E = experienced, I = inexperienced
[b] From communication with FB&DU, July 1982
[c] From Job Service, Price, Utah, July 20, 1982
[d] Can come from MSHA graduates of the College of Eastern Utah, Price, Utah.

Currently, as shown in Table 4, 10 job slots would have to be filled by in-migrants, with 100 positions being filled by Carbon County residents. This assumes a continuation of the depressed coal market and the resultant excess of unemployed workers. The Carbon County communities where the UCO work force probably will reside, and the numbers of applicants in these communities, are detailed in Table 5.

TABLE 5

PROBABLE SETTLEMENT PATTERNS[a]

Community	Employees
Price	75
Hiawatha	1
Sunnyside	1
Kenilworth	4
East Carbon	6
Helper	12
Total	100

[a] From zip code distribution of miners seeking employment, Job Service, Price, Utah, July 20, 1982.

The community of impact for the 10 in-migrants probably will be Price, Utah, because the in-migrants will fill professional and managerial positions, and because Price is the trade center of the region and is an attractive town for professionals and their families to locate. However, the incorporated communities in Carbon County have been studied to determine the capacity of each community to absorb the in-migrants. Chapter III describes the existing infrastructure of towns in Carbon County.

II. OVERVIEW OF THE POPULATION BASE AND ECONOMIC FACTORS

The objectives of this chapter are to describe the economic base and population history of Carbon County, and to forecast the future population of the county. Thus the information presented below is intended to show the population and economic activity.

A. THE AREA'S ECONOMY

The figures from the first quarter of 1982 indicate that Carbon County's economic health is dominated by mining, which accounts for 29.5 percent of all nonagricultural jobs. Of the remaining nonagricultural jobs, 21.3 percent are government slots, followed by the trades with 18.1 percent and by services with 13.2 percent. These four standard industrial classifications comprise 82.1 percent of nonagricultural employment slots in Carbon County. A six-quarter comparison of employment by labor sector is given in Table 6. The employment in real numbers is detailed in Table 7.

Since coal mining is a dominant labor sector of the Carbon County economy, projections through the year 1990 for the coal industry should be instructive. Coal employment projections completed in 1981 by the Southeastern Utah Association of Local Governments appear in 1982 (only 1 year later) to be too optimistic. Few doubt that the demand for coal will increase; however, how soon and how continuous that upturn will be is a major point of conjecture. A list noting the existing and

TABLE 6

PERCENT LABOR FORCE
NONAGRICULTURAL JOBS IN CARBON COUNTY

	3rd Quarter 1980	4th Quarter 1980	1st Quarter 1981	3rd Quarter 1981	4th Quarter 1981	1st Quarter 1982
Mining	28.2	27.8	28.6	29.1	29.2	29.5
Contract-Construction	4.2	4.5	3.4	3.8	4.0	3.1
Manufacturing	3.0	3.2	3.3	3.0	3.2	3.3
Durable Goods	0.6	0.5	0.5	0.6	0.5	0.5
Nondurable Goods	2.4	2.7	2.8	2.4	2.7	2.8
Transportation, Communication & Public Utilities	7.8	7.4	8.6	7.6	7.4	8.8
Trade	20.7	19.7	18.4	20.7	19.3	18.1
Wholesale	5.3	5.0	4.6	5.4	5.0	4.6
Retail	15.4	14.7	13.8	15.3	14.3	13.5
Fire	2.7	2.7	2.7	2.8	2.7	2.7
Service	13.0	13.3	13.0	13.1	13.4	13.2
Government	20.4	21.6	22.0	19.9	21.0	21.3
Federal	2.0	1.9	2.2	2.0	1.9	2.1
State	4.4	5.5	5.6	4.3	5.3	5.4
Local	14.0	14.2	14.2	13.6	13.8	13.8
Total Non-agricultural Jobs[a]	100	100	100	100	100	100

[a] May not add to 100 as a result of rounding.

TABLE 7

SUMMARY - EMPLOYMENT IN CARBON COUNTY

Labor Sector	Third Quarter 1980	Fourth Quarter 1980	First Quarter 1981	Third Quarter 1981 (p)	Fourth Quarter 1981 (p)	First Quarter 1982 (p)
Civilian Labor Force	9,829	9,951	9,863	10,060	10,263	10,149
Employed	9,233	9,506	9,371	9,533	9,822	9,653
Unemployed	596	445	492	528	441	496
Percent Labor Force	6.1	4.5	5.0	5.2	4.3	4.9
Percent Seasonally Adjusted	5.1	4.9	5.3	4.4	4.7	5.2
Total Nonagricultural Jobs	8,452	8,791	8,707	8,536	9,099	8,956
Mining	2,384	2,441	2,493	2,485	2,653	2,646
Contract Construction	359	393	299	326	360	277
Manufacturing	256	278	285	253	289	293
Durable Goods	52	44	42	53	45	43
Nondurable Goods	203	234	243	200	243	250
Transporation, Communication & Public Utilities	655	647	752	651	670	785
Trade	1,747	1,727	1,606	1,771	1,753	1,624
Wholesale	445	438	404	463	454	417
Retail	1,302	1,289	1,202	1,308	1,298	1,207

TABLE 7 (Cont)

Labor Sector	Third Quarter 1980	Fourth Quarter 1980	First Quarter 1981	Third Quarter 1981 (p)	Fourth Quarter 1981 (p)	First Quarter 1982 (p)
Finance, Insurance & Real Estate	232	241	236	235	246	239
Service	1,095	1,165	1,130	1,118	1,218	1,179
Government	1,724	1,898	1,906	1,697	1,910	1,912
Federal	172	167	191	172	169	192
State	371	481	484	369	483	486
Local	1,181	1,250	1,231	1,156	1,258	1,233
Job Market Activities						
New Applications	768	552	762	822	605	461
Job Openings	475	472	415	718	724	355
Job Placements	351	418	341	585	605	327

(p) = preliminary

Source: Utah Department of Employment Security, Labor Market Information Services Section proposed Carbon County coal mines with their respective employment levels (actual for 1980 and 1981 and projected from 1982 through 1990) is contained in Table 8. A major event noted on the list is Sunoco Energy Development Company's (SUNEDCO) purchase of the Sage Point-Dugout Mine property. This mine has the potentially equivalent production capacity of the Coastal States Skyline Complex; thus, for purposes of projecting employment, the Skyline complex employment figures were used with construction commencing in 1984. The optimistic nature of the forecast, although tempered by the current downturn, is based largely on the projected requirement of 8 million tons of coal annually by the Intermountain Power Project (IPP) under construction in Delta, Utah. In August, there has been significant speculation that the IPP may scale down from 4 units to 2, which should half the demand for coal from 8 million to 4 million tons. The future economic health of Carbon County appears good, if coal continues to be in demand. Should coal demand in the county remain flat, then the economic conditions in the county would in all probability be flat.

Prior to July 1982, the unemployment rate in Carbon County has been typically below the Utah average. The 1980 unemployment rate for the county was 5 percent, seasonally adjusted, compared with 5.2 percent in the first quarter of 1982. In July 1982, the seasonally adjusted unemployment rate for Carbon County, according to the Utah Job Service, was 9.2 percent, compared with the State rate of 8.0 percent.

TABLE 8

ACTUAL AND PROJECTED
SOUTHEASTERN UTAH COAL EMPLOYMENT

	Actual		Projected[a]								
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Carbon County											
Beaver Creek Coal - Gordon Creek #'s 2,3,6	170	170	170	170	170	170	170	170	170	170	170
Blazon; Blazon #1		14	14	14	14	14	14	14	14	14	14
California-Portland Cement	120	155	170	170	170	170	170	170	170	170	170
Coastal States-Skyline		52	150	150	200	220	500	650	800	900	900
C&W Coal Producers		35	35	35	70	70	70	70	70	70	70
First Western Coal Aletha		15	35	40	40	40	40	40	40	40	40
Kaiser Steel Corp.	430	468	468	468	468	468	468	468	468	468	468
Plateau Mining	250	250	250	300	300	300	300	300	300	300	300
Price River Coal	607	607	607	620[b]	620	620	620	620	620	620	620
				(1020)[b]	(1020)	(1020)	(1020)	(1020)	(1020)	(1020)	(1020)
Tower Resources	35	90	90	90	150	150	150	150	150	150	150
UCO Inc. Scofield[c]			77	109	109	109	109	109	109	109	109
U.S. Fuels	300	375	400	400	425	450	500	725	725	725	725
Valley Camp Belina #1	260	320	320	500	500	500	500	500	500	500	500
SUNEDCO - Sage Point - Dugout[d]					52	150	150	200	220	500	650
Carbon County Totals	2,172	2,551	2,786	3,016	3,188	3,331	3,761	4,186	4,356	4,736	4,886

TABLE 8 (Cont)

	Actual		Projected[a]								
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990

[a] Projected employment levels based upon estimated total coal production capacity--due to various unforeseeable economic and market conditions, the future coal production may possibly fluctuate.

[b] Employment projection depending on market demand for coal.

[c] Data in this report indicate that employment for 1982 is 0, and that each projection from 1985 through 1990 is 110 (see Table 1 in Chapter 1).

[d] See Utah Energy Developments, Utah Energy Office, 1981, p. 57.

Source: Nancy Ingold, Southeastern Utah Energy Development 1982, Southeastern Utah Association of Local Governments, pp. 49-50.

B. HISTORICAL AND PROJECTED POPULATION PATTERNS

Carbon County has experienced a large population flux over the past 30 years. In 1950, the county population was 24,901. By the time of the 1960 U.S. Census, it had declined to 21,135; and it declined even further by 1970 to 15,647. In 1980, according to the U.S. Census, the population had increased to 22,179. The estimated 1981 Carbon County population was 23,200 (Utah Economic and Business Review, "1981 Population Estimates for Utah"). Thus, Carbon County has not regained the 1950 population level potentially indicating that the infrastructure may be in place, but has aged. The latest population projections assume that the historical fluctuation will not occur in the next 20 years but rather that the county will experience a steady increase in population.

Table 9 contains the 1970-1980 population patterns for the towns in Carbon County. Most of the population growth has occurred in the incorporated areas; only 27.3 percent of the total county population resides in unincorporated areas. From 1970 to 1980, virtually all of the growth (98 percent) occurred in the incorporated areas.

The State Planning Coordinator's Office (SPCO) has run population projections to the year 2000 (see Table 10). The baseline scenario shows Carbon County growing by 58.5 percent from 1980 through 1990, compared with only 7.1 percent for the decade from 1990 through the year 2000. Most of the annual growth rates are uniformly around 4 percent, except for the years 1982 through 1983, during which the population is projected to grow by 9.8 percent. The projections already appear to be too optimistic regarding the rate of growth.

Demographically, the 1980 age and sex distribution of the population in Carbon County is shown in Table 11. The age distribution is particularly important in projecting demand for municipal-type services, particularly for education.

TABLE 9

POPULATION PATTERNS IN CARBON COUNTY

Census Division	1970	1980	Percent Increase
East Carbon Division	--	2,570	--
East Carbon City	--	1,942	--
Sunnyside	485	611	26.0
Helper Division	--	4,620	--
Helper City	1,964	2,724	38.7
Scofield Town	71	105	47.9
Price Division	--	14,989	--
Hiawatha Town (pt)	166	249	50.0
Price City	6,216	9,086	46.1
Wellington City	922	1,406	52.5
Carbon County Total	15,647	22,179	41.7

Source: U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population and Housing, PHC80-V-46, Utah, p. 10.

TABLE 10

SOUTHEASTERN UTAH POPULATION PROJECTIONS - BASELINE

Year	Helper CCD	Helper	Scofield	Unincorp	Price CCD	Price	Wellington	Hiawatha	Unincorp	East Carbon CCD	East Carbon	Sunnyside	Unincorp	Carbon County Total
1980	4,620	2,724	105	1,791	14,989	9,086	1,406	249	4,248	2,570	1,942	611	17	22,179
1981	4,958	2,927	110	1,921	15,566	9,436	1,460	250	4,420	2,554	1,930	607	17	23,078
1982	5,074	2,992	117	1,965	16,525	10,043	1,550	251	4,681	2,584	1,952	614	18	24,183
1983	5,455	3,217	122	2,116	18,573	11,313	1,770	253	5,237	2,514	1,900	597	17	26,542
1984	5,574	3,288	125	2,161	20,610	12,594	1,999	255	5,770	2,468	1,865	587	16	28,652
1985	5,878	3,468	129	2,281	21,653	13,229	2,118	254	6,052	2,412	1,822	574	16	29,942
1986	6,096	3,603	133	2,360	22,497	13,780	2,213	256	6,248	2,366	1,788	562	16	30,959
1987	6,292	3,724	135	2,433	24,296	14,922	2,392	257	6,625	2,281	1,724	542	15	32,869
1988	6,448	3,817	139	2,492	25,010	15,401	2,463	260	6,886	2,228	1,684	530	14	33,686
1989	6,583	3,892	140	2,551	25,670	15,848	2,528	259	7,035	2,244	1,696	533	15	34,496
1990	6,573	3,891	140	2,542	26,332	16,299	2,594	257	7,182	2,254	1,703	536	15	35,159
1991	6,666	3,947	145	2,574	26,839	16,656	2,645	255	7,283	2,264	1,711	538	15	35,769
1992	6,747	3,994	146	2,607	26,265	16,964	2,687	255	7,359	2,272	1,171	540	15	36,285
1993	6,809	4,031	149	2,629	27,629	17,234	2,723	253	7,419	2,275	1,719	541	15	36,713
1994	6,857	4,059	150	2,648	27,911	17,455	2,752	250	7,454	2,270	1,715	540	15	37,039
1995	6,793	4,021	148	2,624	28,164	17,659	2,777	251	7,477	2,260	1,708	537	15	37,218
1996	6,802	4,027	149	2,626	28,270	17,770	2,708	250	7,462	2,245	1,696	534	15	37,317
1997	6,801	4,027	149	2,625	28,365	17,850	2,797	252	7,466	2,228	1,684	530	14	37,394
1998	6,802	4,027	149	2,626	28,465	17,984	2,807	254	7,420	2,211	1,671	525	15	37,478
1999	6,811	4,032	149	2,630	28,567	18,094	2,817	254	7,402	2,195	1,659	522	14	37,572
2000	6,815	4,034	150	2,631	28,664	18,202	2,827	254	7,381	2,177	1,645	517	15	37,656

Source: State Planning Coordinators Office, August 16, 1982

Demographically, Carbon County has a population dominated by people of labor force age; that is, their ages range between 18 and 64 . Almost 56 percent of the population falls within that age range, while approximately 35 percent are school-aged or younger.

TABLE 11

AGE AND SEX POPULATION IN CARBON COUNTY

Age	Male	Female	Total	Percent of County Population
less than 5 years	1,402	1,397	2,799	12.6
5-17 years	2,416	2,497	4,913	22.2
18-24 years	1,448	1,422	2,870	12.9
25-44 years	3,002	2,722	5,724	25.8
45-64 years	1,756	1,960	3,716	16.8
65-84 years	910	1,078	1,988	8.9
85 + years	70	99	169	0.8
Totals	11,004	11,175	22,179	100

Source: U.S. Department of Commerce, Bureau of the Census, 1980, "Age and Sex Population by County", Utah, Summary Tape File 1, Tables 10 and 12.

C. SUMMARY

It may be accurate to say that "as coal goes, so goes Carbon County." The mining sector dominates the nonagricultural jobs, and historically has determined population levels. In 1980, Carbon County had not regained its population size of 1950; however, the SPCO projects that the 1950 levels will be exceeded during 1982 and 1983. Whether the projected population increases materialize will depend primarily on the coal market regaining its momentum. In August 1982, the outlook for coal may be a further continuation of the soft market.

III. OVERVIEW OF MUNICIPAL SERVICES IN CARBON COUNTY

The subject of this chapter is to detail the municipal-type services currently available in Carbon County. These services are discussed in terms of the communities' abilities to provide services in this current year (1982) to Carbon County residents. Because of the proximity of the Scofield Mine to the town of Scofield, the area near Pleasant Valley (in which Scofield is located) has received close scrutiny. The Price-Helper area also has been examined carefully, since most of the UCO workers are projected to originate from that area (see Table 5). To establish a county-wide view of the available services, a Carbon County total has been included when discussing service levels. The following presentation is organized by services (housing, education, etc.) and by town.

A. HOUSING

The 1980 U.S. Census revealed that housing in Carbon County increased at a slightly higher rate than population; housing units increased 45.2 percent over the decade compared with a 41.7 percent population increase. In 1981, 131 construction permits for new dwellings in Carbon County were issued (BEBR, March 1982). From January through June 1982, construction permits were issued for 125 dwelling units in the county, with 56 percent of those being multi-family units (BEBR, Construction Report, 1982).

According to the 1980 U.S. Census, the average household size was 2.7 people per housing unit. Should the 1990 population projections be realized and the 2.7 household rate hold constant, then Carbon County should expect to see 4,830 new dwelling units through 1990.

Vacancy rates for housing units in Carbon County have not been compiled. Telephone conversations with local realtors indicated that vacancy rates are very low, perhaps between 1 or 2 percent. Using this range, Carbon County should have between 81 and 162 vacant dwellings in the summer of 1982. Table 12 indicates the housing units in Carbon County. Should this rate of vacancy be accurate and also continue, permanent housing for workers would not be impossible.

Transient housing in the form of motel and hotel rooms exists. In Price, 400 such rooms are available; vacancy rates are 5.5 percent in the summer and 26.5 percent in the winter (Burnett, 1981). Applying the 5.5 percent vacancy rate on a yearly basis yields 22 rooms available on an interim basis. Helper has 164 motel/hotel rooms available; vacancy rates are 45.3 percent in the summer and 50 percent in the winter, or 89 units that would be available on a temporary basis based on the summer vacancy rate. Thus, transient housing for the construction work force should be adequate.

B. EDUCATION

In the autumn of 1981, Carbon County elementary, junior and senior high schools had enrollments of almost 5,000 students, with 243 teachers, for a teacher-student ratio of 20.5. State

TABLE 12

HOUSING UNITS IN CARBON COUNTY

Census Division	1970	1980	Percent Change	Potential[a] Vacancy 1%
East Carbon Division	--	938	--	9
East Carbon City	--	726	--	7
Sunnyside City	155	202	30.3	2
Helper Division	--	2,163	--	21
Helper City	826	1,072	29.8	10
Scofield Town	74	89	20.3	0
Price Division	--	5,091	--	50
Hiawatha Town (pt)	71	81	14.1	0
Price City	2,082	3,202	53.8	32
Wellington City	277	433	56.3	4
Carbon County Totals	5,642	8,192	45.2	81

[a]FB&DU computation.

Source: U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population and Housing, Advance Reports, Utah, PHC80-V-46, p. 10.

standards call for 1 teacher per 23 students at the elementary level, and 1 teacher per 30 students at the junior and senior high school levels. Currently, education capacity is not strained in Carbon County.

Utah State Office of Education projections indicate that enrollment in Carbon County schools will exceed capacity by 188 students for the 1983-84 school year. An additional 11 teachers would be required by Autumn 1983. Table 13 lists the 1981 enrollment figures by public schools in Carbon County. The Notre Dame private elementary school enrolls 300 students and is at capacity.

To project the number of students in Carbon County through 1990 involves much supposition. If the demographic distribution of the 1980 U.S. Census is used, 22.2 percent of the Carbon County population falls within the school-age category. Applying 22.2 percent of the population to the projected 1990 population of 35,159, then Carbon County can expect 7,805 students by 1990, or 2,186 students beyond the current physical capacity of the school. An additional 96 teachers would be required by 1990 should the population projections occur and should the 1980 demographic makeup be realized.

The College of Eastern Utah is located in Price. In 1980, the College had an enrollment of 851 students.

C. WATER

In the western United States, the supply of water may be one of the more critical elements that constrains growth. For a socioeconomic analysis the primary concern is for potable or culinary water and available water connections.

Price has a water system that also services Helper and Wellington that is approved by the State of Utah Department of Health. This system, part of the Price River Water Improvement

TABLE 13

CARBON COUNTY 1981 PUBLIC SCHOOL ENROLLMENT AND CAPACITY

School	Grades	1981 Autumn Enrollment	1982 Capacity	No. of Teachers	Surplus (Deficit)
Elementary					
Castle Heights (Price)	K-6	539	559	20	20
Durrant School (Price)	K-6	526	592	25	66
Sally Mauro (Helper)	K-6	464	472	18	8
Petersen School (Sunnyside)	K-6	324	394	15	70
Price School (Price)	K-6	536	817	31	281
Reeves School (Price)	K-6	292	236	14	(56)
Wellington School (Wellington)	K-6	341	325	13	(16)
Subtotal		3,022	3,395	136	373
Junior High					
Helper Junior High (Helper)	7-9	245	316	15	71
Mount Harmon (Price)	7-9	657	764	29	107
Subtotal		902	1,080	44	178
High Schools					
Carbon High School (Price)	10-12	786	716	38	(70)
East Carbon High (Sunnyside)	7-12	200	343	17	143
Subtotal		986	1,059	55	73
Special Schools					
Carbon-Emery Alternative High (Price)	10-12	38	--	2	--
Ann Self School (Helper)		28	85	6	57
Subtotal		66	85	8	57
Total		4,976	5,619	243	681
Projected 1983-1984		5,845	--	---	--

Source: Utah State Office of Education, "Statistical and Cost Supplement to 'A Report on School Buildings in Utah'", January 1982, pp. 13 and 61.

District, (PRWID) can deliver 4 million gallons per day and has a storage capacity of 5.75 million gallons (BEBR, County and Community Economic Facts, 1980). Currently, there are 3,010 service connections, and the system can accommodate an additional 400 connections (Utah Economic Facts, March 1981). The Price water system can meet peak demand and still be adequate to meet fire flows.

Helper, which also is serviced by the Price River Water Improvement District, has a water system with 1,035 connections, with the capacity to deliver 4 million gallons per day and a storage capacity of 3 million gallons. The system currently cannot meet peak demand; consequently, Helper can accommodate little growth (Community Economic Facts, 1982).

Scofield has a moratorium on new hook-ups (Pleasant Valley Growth Management Plan, 1981). The water system can supply 290 gallons per day per connection, significantly below the 800 gallons per day required by the State of Utah Department of Health. The inability of the current system to support growth may be one of the reasons why the State Planning Coordinator's Office (SPCO) projects little growth for Scofield through the remainder of this century (see page 2-10, this report).

In summary, Price is one of the towns in Carbon County that can support additional growth. The water systems of other towns not considered above (Hiawatha, East Carbon City, and Wellington) also can support additional population. Water availability will constrain population growth in Scofield and Helper.

D. SEWER SYSTEMS

Price, Helper, and Wellington are serviced by the Price River Water Improvement District (PRWID). The 1.8 million gallon per day sewer system can support the population equivalent of 24,100 (BEBR, County and Community Economic Facts, 1980). Should the SPCO population projections materalize, the system will meet capacity in 1984-1985. Consequently, new collection lines and expanded treatment facilities will be needed by PRWID after 1985.

Improvements for the PRWID system are currently 18th on the Utah priority list, and will require $382,000 of Fiscal Year 1983 Federal Wastewater Funds for new collection lines (State of Utah Department of Health, August 1982). The system is ranked 6th for 1985-1986 dollars, and will require $6.5 million to upgrade treatment capacity. The expansion is for 4 million gallons per day, or sufficient to support more than 50,000 people, more than projected for Carbon County through the year 2000.

Scofield has no municipal wastewater system. Septic tanks and pit privies dominate the inadequate system. Scofield ranks 36th in priority for the Federal Wastewater Funds for fiscal year 1983, or behind Kenilworth, Price, and Hiawatha.

E. FIRE

Carbon County relies on volunteer fire departments. Price has 15 volunteers, 2 pumper trucks, and a fire station. Helper has a volunteer force, 1 pumper truck, and a fire station. Both Price and Helper have an insurance rating of 6 within city limits. East Carbon has a volunteer force, 1 pumper truck, a fire station, and an insurance rating of 7 within the city limits. Scofield has 2 pumper trucks, but insufficient water pressure to contain a major fire. Carbon County has 10 volunteers and 2 pumper trucks; the County Carbon has joint fire protection with Price and Helper. The County insurance rating is 10, typical of rural communities (BEBR, County and Community Economic Facts, 1980-1981).

F. <u>LAW ENFORCEMENT</u>

Carbon County law enforcement is provided by 14 sheriff officers and 23 municipal officers, for an officer-per-1,000-population ratio of 1.67, which is the 7th best in Utah (State of Utah Department of Public Safety, 1980). The overall Utah ratio was 1.68 officers per 1,000 population.

Price has 12 officers, 5 vehicles, and a jail. Helper has 5 officers, 3 vehicles, and a detention facility. East Carbon has 5 officers and 2 vehicles. Scofield has 1 vehicle, but currently no officer.

The crime rate per 1,000 population is 41.93, compared with the Utah statewide average of 58.83. In short, the crime rate for Carbon County is lower in magnitude than for the State as a whole.

G. TRANSPORTATION

The major roads that will be considered for the Scofield Mine are State Route 96 which goes through Scofield, and State Routes 6, 10, and 50. Table 14 details the annual average daily traffic on the routes that will be used either for haulage (State Route 96) or as worker routes (State Routes 96, 6, 10, and 50).

TABLE 14

ANNUAL AVERAGE DAILY TRAFFIC

Highways	1977[a]	1978[a]	1979[a]	1980[b]	1981[b]
6 State Route 96 to Scofield	4,450	4,085	3,910	4,055	4,325
6 North Including Helper	10,500	11,025	11,500	12,185	12,490
6 South Including Helper	10,200	10,800	11,000	11,925	12,225
6 Price Bypass	NA	NA	8,000	8,290	8,500
10 Price South Urban Boundary	8,890	9,500	9,900	10,400	10,600
SR 96 North Including Scofield	385	190	195	200	500
96 South Including Scofield	385	190	195	200	500
96 Clear Creek	340	170	175	180	480

[a]Source: Traffic on Utah Highways, 1979, State of Utah Department of Transportation.

[b]Source: Traffic on Utah Highways, 1981, State of Utah Department of Transporation

The design capacity of these two-lane roads is 1,000 vehicles per peak hour. The coal haulage route will not exceed design capacity. The fact that traffic from State Route 6 to Scofield is diminishing is significant. While almost 4,500 trips daily are recorded at the junction of State Routes 6 and 96, only 500 trips daily are recorded through the town of Scofield. Thus, it appears that most of the recreation traffic stops short of Scofield, lessening the intermingling of recreation traffic with coal-related transportation.

H. RECREATION

In the vicinity of the Scofield Mine are both public and private parks. Both the State of Utah and Carbon County have a park. Scofield Reservoir has an annual visitation of 336,600, or an average of 2,040 visitors at any given time (Pleasant Valley Growth Management Plan, 1981). According to the same report, design capacity of the Reservoir is for 550 people and 137 boats at any given time. The State and Carbon County both recognize that expansion of the facilities at the Reservoir is necessary.

Other outdoor recreation activities are available in surrounding counties; e.g., Huntington State Park in Emery, Canyonlands and Arches National Park in Grand and San Juan Counties. Hunting opportunities exist in the Manti-LaSal National Forest in Sanpete and Emery Counties. Private hunting clubs also exist in the Pleasant Valley area.

Price has a golf course; Price and Helper have community parks with swimming pools and tennis courts. Indoor recreation activities in Price and Helper can be pursued at bowling alleys and movie theaters. Within Carbon County and the towns, a variety of recreational opportunities exists.

I. HEALTH CARE

Health care in Carbon County is available from 15 physicians, 9 dentists, and 100 registered nurses (State of Utah Department of Health, 1981). Castleview Hospital is a 70-bed facility located in Price. Utilization data for the hospital are detailed in Table 15. The 61.3 percent occupancy rate compares with a statewide average in 1980 of 69.8 percent. Currently, some citizens are attempting to get another hospital in Price.

TABLE 15

HOSPITAL UTILIZATION FOR CASTLEVIEW HOSPITAL PRICE, UTAH

	1975	1976	1977	1978	1979	1980
Admissions	2,691	3,054	3,208	3,643	3,476	3,602
Patient Days	14,763	13,872	15,173	17,419	16,115	15,693
Average Length of Stay	5.49	4.54	4.73	4.78	4.64	4.36
Beds (ave/yr)	73	75	75	75	70	70
Percent Occupancy	55.4	50.4	55.4	63.6	63.1	61.3

Source: Utah Department of Health, 1981.

Coal mines have an ambulance and trained emergency medical technicians (EMTs) at each mine. Planning now calls for UCO to have its own ambulance and EMTs for emergency care at the site.

J. FISCAL

The assessed valuation of the major entities has shown great growth from 1978 through 1981; however, the growth is misleading in that the state officials re-evaluated the property during this time frame. The 1978 assessed valuation is compared with that for 1981 in Table 16.

TABLE 16

COMPARATIVE ASSESSED VALUATION FOR 1978 AND 1981

Locale	1978[a]	Mill Levy	1981[b]	Mill Levy
Carbon County	$62,075,860	16.0	$102,099,996	16.0
Price	10,550,449	17.0	25,294,107	14.44
Helper	2,532,052	16.0	6,487,653	8.0
Scofield	130,155	8.0	269,413	7.53
Carbon Water District	62,075,860	2.0	102,099,996	0.50
Price River Water District	39,783,785	9.0	71,213,402	6.79

[a]Burnett, Four Corners Regional Commission Southeastern Utah Regional Report and Investment Strategy, 1980.

[b]Utah Foundation, Statistical Review of Government in Utah, 1982.

Given the past growth in the area shown in Table 16, the continuing residential construction, and the forecast growth, the assessed valuation in Carbon County should continue to increase. As shown in Table 16, mill levies have declined in all jurisdictions except Carbon County, where the mill levy in 1981 was the same as for 1978. No jurisdiction has approached its legal maximum mill levy.

K. GENERAL FUND REVENUES

Table 17 presents the general fund revenues for the prospective impacted entities. Sales tax is the major source of revenue for municipalities except for Scofield, where inter-governmental grants (both state and federal) were the largest revenue item. In Carbon County, the property tax is the primary source of revenue. All entities levy a 0.0075 dollars per dollar local option sales tax.

The entitites vary greatly in the amount of revenue generated; however, per capita revenue is around $190 except for Scofield, where revenue is almost $400 per resident. If the Utah and Federal drought grants are removed from the Scofield budget, revenue falls to a low $55.83 per person. User fees are used by all entities except Scofield. By means of user fees, growth can help pay for itself.

While the water districts are not detailed on Table 17, the Price River Water Improvement District has operating revenues of $586,038, compared with operating expenses of

TABLE 17

GENERAL FUND REVENUES FOR PROSPECTIVE IMPACTED TOWNS (1981)

	Price	Per Capita	Helper	Per Capita	Scofield	Per Capita	Carbon County	Per Capita
Taxes	$1,127,970	$124.14	$227,900	$83.66	$4,971	$47.34	$1,897,452	$82.22
Property	350,419	38.57	55,535	20.39	1,369	13.04	-0-	-0-
Sales	747,851	82.30	164,922	60.54	3,602	34.30	-0-	-0-
Franchise	29,700	3.27	-0-	-0-	-0-	-0-	-0-	-0-
Licenses	86,565	9.53	14,925	5.48	273	2.60	100,279	4.35
Intergovernment	345,819	38.06	37,268	13.68	35,558	338.65	935,137	40.52
Charges	107,944	11.88	43,770	16.07	-0-	-0-	446,364	19.34
Fines	56,279	6.19	8,595	3.16	-0-	-0-	122,531	5.31
Miscellaneous	90,926	10.01	19,762	7.25	618	5.89	542,322	23.50
Contributions	-0-	-0-	-0-	-0-	-0-	-0-	5,500	0.24
Total	$1,815,503	$199.81	$519,070	$190.55	$41,420	$294.48	$4,049,585	$175.47
Population	9,086		2,724		150		23,078	
Assessed Valuation 1981	$25,294,107		$6,487,653		$269,413		$102,099,996	

Source: Audited Budgets, Statistical Review of Government in Utah, 1982.

$812,698. When $506,561 in property taxes are figured in, the water district in 1980 had unobligated income less depreciation, of almost $60,000. Recent audited statements for Carbon Conservancy District are not on file with the State Auditor.

L. GENERAL FUND EXPENDITURES

General fund expenditures, in terms of both actual dollars and per capita dollars, are detailed in Table 18. Since a budget is a numerical statement of priorities, then the following conclusions can be drawn: Price is concerned with streets and public safety; Helper has per capita expenditure levels similar to Price; Scofield spent more on drought relief, with general government the next highest level of per capita expenditures; and general government costs for Carbon County account for almost 40 percent of operating costs, followed by public safety and roads.

Parks receive more attention in the municipalities than in the county, with Price residents paying almost $41 per capita. All jurisdictions rely on transfer from special funds to achieve a balanced budget.

M. SUMMARY

This chapter has attempted to describe 1982 baseline services conditions in Carbon County and selected jurisdictions. A summary of the services by town can be found in Table 19. The next chapter describes the UCO impact on these environs.

TABLE 13

GENERAL FUND EXPENDITURES (1981)

	Price	Per Capita	Helper	Per Capita	Scofield	Per Capita	Carbon County	Per Capita
General Government	$505,666	$55.65	$107,502	$39.46	$2,860	$27.24	$1,477,932	$64.04
Public Safety	591,089	65.05	203,070	74.55	-0-	-0-	964,217	41.78
Highways	719,419	79.18	135,696	49.81	2,336	22.25	953,683	41.32
Public Health	16,701	1.84	3,000	1.10	93	0.89	96,984	4.20
Draught Relief	-0-	-0-	-0-	-0-	35,161	334.87	-0-	-0-
Parks	370,992	40.83	42,187	15.49	-0-	-0-	99,822	4.33
Conservation & Economic Development	813	0.09	-0-	-0-	-0-	-0-	76,557	3.32
Intergovernment	-0-	-0-	500	0.18	29	0.28	116,714	5.06
Total General Government	$2,204,680	$242.64	$491,955	$180.60	$40,479	$385.51	$3,785,909	$164.05
Population	9,086		2,724		105		23,078	

Source: Audited Budgets.

TABLE 19

SUMMARY OF MUNICIPAL SERVICES

Town	Law Enforcement	Fire	Water	Sewer	Garbage	Housing	Social	Recreation	Health Care
Price	12 officers 5 vehicles Jail	Volunteer 15 volunteers 2 vehciles pumpers 1 fire station 6 rating	3,010 connections Can accommodate 427 new connections	Trickling filter 1.8-mgd capacity 3.2-mgd use 4-mgd expansion #109, (85-86) 53,000 upgrade collection #17 on wastewater upgrade treatment to meet H_2O quality standards	Land fill	83% single-family dwellings 7.4% mobile homes 9.8% multi-family 400 motel/hotel	Alcohol & drug abuse assistance Senior citizen council Battered spouse	Community parks Tennis courts Swimming pools Bowling alleys Movie theater Golf course	70 beds 15 physicians 9 dentists 101 RN active 28 inactive
Helper	5 officers Detention 3 vehicles	Volunteer 1 pumper 1 fire station 6 rating	1,035 connections 4 mgd Deteriorating water system Cannot meet peak	Trickling filter 1.8-mgd capacity, or 24,100 pop. equivalent 4,500 taps	Land fill	87% single-family 4.5% mobile homes 8.3% multi-family 164 motel/hotel rooms	Alcohol & drug abuse assistance Senior citizen council	Community parks Tennis courts Swimming pools Bowling alley	
Hiawath	County Sheriff	None	50 connections 70 taps Can meet peak	None 70 taps	None	100% single-family	Alcohol & drug abuse Senior citizen council		
East Carbon	5 officers 2 vehciles	1 pumper 1 fire station 7 rating	830 connections 1.5-mgd	Clarigester 2.2-mgd capacity	Open dump	97.6% single-family 2.4% mobile homes	Alcohol & drug abuse Senior citizen council	Tennis courts Movie theater	

TABLE 19

SUMMARY OF MUNICIPAL SERVICES
(Continued)

Town	Law Enforcement	Fire	Water	Sewer	Garbage	Housing	Social	Recreation	Health Care
Carbon County	14 officers 4 vehicles Jail	Volunteer 10 volunteers 2 pumpers		Mechanical treatment Priority #18 for $382,000 (82-83) for new collection (PRWID) (85-86) $6.5 M to upgrade treatment #78	County land fill	80.2% conventional 14.2% mobile homes 5.6% multi-family	Alcohol & drug abuse Senior citizen center	Tennis courts	
Scofield	None 1 vehicle	Water inadequate for fire 2 pumpers	No supply Moratorium on new hookups	Septic tank problems	People dump own in open pit	85% conventional 15% mobile homes		County park at Scofield Reservoir 300-400 cars can be accommodated	Mine ambulance 2 EMT

IV. POPULATION AND SERVICE IMPACTS GENERATED BY THE SCOFIELD MINE

Current planning is for UCO, Inc. to begin construction of the Scofield Project in the spring of 1983. At peak construction, 75 workers will be required as follows: 20 for the coal loadout facility, 20 for surface facilities and road enhancement, and 35 to drive the slopes for the mine.

The combined peak workforce of 40 for the coal loadout facility, the surface facilities, and the road construction work will be subcontracted to local construction firms. The 35 job slots needed for slope construction will be filled from the existing pool of the unemployed. Construction management and engineering personnel may not be obtainable from the local workforce. Should these professional and managerial positions be filled outside of Carbon County, a temporary influx for 10 construction jobs slots can be expected. These workforce requirements will have some impact on the area as detailed in the following section.

A. POPULATION IMPACTS

Peak construction of the Scofield Project will occur in 1983, and peak operations in 1985. Given the current economic picture, this assessment assumes that local coal miners and construction firms will be available and can perform the requisite work. The in-migration requirements of the project for 1983-1985 are shown in Table 20.

TABLE 20

DIRECT JOB SLOT IN-MIGRATION FORECAST

	1983	1984	1985
Construction	10	--	--
Operations	--	5	5
Total	10	5	5

These job slots create additional increases in population vis-a-vis the moving of the worker's family into the area, and also by generating more economic activity that induces people to move into the area to participate in economic good fortune. From Table 20 above, in 1983 the 10 construction job slots may not create the population movement typically associated with energy development, simply because of the short term, transitory, nature of construction. However, for the purpose of this report, it will be assumed that the construction workers will move their families. The assumption is made to permit a potential overstatement of population growth rather than to understate that growth.

In 1984, 5 professional and managerial operations job slots will be created, and in 1985, an additional 5 job slots will become necessary to achieve peak operation. Thus, combining these slots will produce a total of 10 slots to be filled by in-migrants during the years of 1984 and 1985. These slots represent a permanent population increase.

Another contribution to population growth are the induced or non-basic, job slots. Broadly speaking, induced job slots occur in the trades and services sector of the economy and support the needs of, in this case, the mining industry. For the purpose of this assessment, a 1.6 multiplier is used; that is, for every direct job slot, 0.6 of an induced job slot is generated. While this multiplier is consistent with the Housing and Urban Development's Rapid Growth from Energy Projects (1976) and the Environmental Protection Agency's Action Handbook (1978), its use probably overstates the indirect impact.

Thus, to compute induced labor, the 1.6 multiplier is applied only to the in-migrant job slots, since the indigenous population currently receives goods and services. Multiplying 0.6 by the 10 construction job slots filled by in-migrants predicts 6 additional nonbasic induced in-migrant job slots. In 1984 and 1985, another 6 additional nonbasic induced in-migrant slots will be filled, or 3 in each year.

The argument can be made that more people may migrate to the area in 1983 to avail themselves of apparently improved economic opportunities; however, the short construction season, coupled with an existing unemployed labor pool, mitigates against a large migration in 1983. More likely to occur economically is that the existing labor force participation rate may increase; that is, local residents may enter the labor force, possibly on a part-time basis to assist in the provision of services.

Demographic data from the 1980 U.S. Census were used to calculate the population impacts generated by the 10 construction in-migrant direct job slots, the 10 operations slots, and the 12 total indirect slots. To compute the percentage of married-versus-single population, the data base generated by the Construction Worker Profile (Mountain West Research, Inc., 1975) and by the Bureau of Reclamation's Construction Worker Survey (Chalmers, 1977) was used. The population impacts are shown in Table 21.

TABLE 21

POPULATION IMPACTS OF FORECAST IN-MIGRANTS

	In-Migrant Direct Construction	In-Migrant Direct Operations	In-Migrant Indirect	Total
Total job slots	10	10	12	32
Single (24.6%)[a]	2	2	3	7
Married (75.4%)	8	8	9	25
Married, Would Not Relocate Family (26.5%)[a]	2	0	0	2
Family Present	6	8	9	23
Household Size of 3.03[b]	12	16	18	46
Total Pop. Impact	22	26	30	78
Adults	16	18	21	55
Children	6	8	9	23

[a] Mountain West Research, Inc. 1975.

[b] Average household size of 3.03 (to avoid double counting, 2.03 was multiplied by "family present"), 1980 U.S. Census, Carbon County, Utah.

B. INCREASED POPULATION DEMANDS

The principal purpose in computing the probable demographic profile of the in-migrant population is to determine the potential impact on the school system. To compute the age of the children who will in-migrate, the age distribution data for Carbon County (Table 11) were used. The age data indicate that 12.6 percent of the children will be less than 5 years of age, or less than school age; the remainder of the children will be school age. Table 22 summarizes the impact on schools.

TABLE 22

IMPACT OF SCHOOL-AGED CHILDREN

	Combined Construction and Operation	Indirect	Total
Total Children	14	9	23
Under School Age, 5 years (12.6%)	2	1	3
School Age, 5 to 17 years (87.4%)	12	8	20

A summary of the demands that the Scofield Project will place on Carbon County resources is given in Table 23.

TABLE 23

PROJECT DEMANDS ON CARBON COUNTY RESOURCES

Schools	An additional 20 children
Housing	32 Units
Water (100 gal/capita day)	7,800 gal/day
Sewer (100 gal/capita day)	7,800 gal/day

The transportation impacts of the population increase are summarized in Table 24.

TABLE 24

WORKER TRANSPORTATION IMPACTS

	Peak Construction	Peak Operations
Daily Trips to Scofield from Price-Helper, Assuming 3 Buses and 15 Auto Trips for Construction	36	--
Daily Trips to Scofield from Price-Helper, Assuming 4 Buses and 30 Automobiles	--	68
Total Roundtrips Daily	36	68

While Table 22 details what the demand for services will be, the important juxtaposition is to determine if the community has sufficient infrastructure capabilities in place to accommodate this 3-year influx of growth. The supply-versus-demand is summed in Table 25.

TABLE 25

UCO DIRECT AND INDIRECT DEMAND VERSUS SUPPLY

	Housing[a]		Sewer/Population[b]		Water/Connections[c]		Police Personnel[d]		Health Care[e]		Education[f]	
	Excess	Demand	Excess	Demand	Excess	Demand	Excess	Demand	Excess	Demand	Excess	Demand
Price	32	30	1,022	70	400	20	-0-	0.12	3	0.04	348	21
Helper	10	2	1,022	8	-0-	2	-0-	0.01	-0-	-0-	79	2
East Carbon	7	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Scofield	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Other	32	-0-	N/A	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-

[a] Based on one home per family, combined direct and indirect impacts.

[b] Based on PRWID population capacity of 24,100, less 1981 estimated Carbon County Population of 23,078.

[c] Based on connections.

[d] Based on national standards of 1.65 offices per 1,000 population.

[e] Based on national standards of 1 M.D. per 1,800 population.

[f] Combined capacity of elementary, junior high and high schools.

As indicated in Table 25, the communities generally have excess capacity to accommodate the UCO driven growth. The two exceptions are water connections in Helper, and law enforcement personnel throughout Carbon County.

C. REVENUE

To offer a balanced view of the impacts created by the Scofield Project, the revenue that will flow through the county also needs to be considered. Table 26 lists the public expenditure pattern.

TABLE 26

UCO EXPENDITURES

	Peak
Payroll Expenditures	$2,600,000 annually
Utah Income Tax[a]	89,800 annually
Property Taxes	84,000 annually
County Royalties	31,500 annually
Capital Expenditures	
Carbon County	1,000,000
Sales Tax	50,000 ($7,500 returned to Carbon County)
Outside Carbon County	9,000,000
Sales Tax	450,000

[a]Utah Income Tax is 26% of Federal income tax, assuming a joint return, and family of four, with standard deductions.

The above Table 26 centered only on the direct expenditures in the area. However, for each dollar spent in the area by UCO, a multiplier effect takes place. A dollar received by an employee or a local business from UCO is spent on other goods and services in the area and is in turn spent on additional goods and services. This multiplier effect increases the fiscal impact of each dollar spent.

The dollar activity multiplier to be used in this analysis is 2.02. That is, for every dollar spent by UCO an additional $1.02 flows through the multiplier effect. The use of this multiplier is substantiated by two documents: The Utah Input-Output Study, and A Guide to Methods for Impact Assessment of Western Coal/Energy Development, prepared by the Western Coal Planning Assistance Project for the Missouri River Basin Commission (January, 1979). Thus, if the 2.02 dollar activity multiplier is applied only against the annual payroll expenditure of $2.6 million, then UCO will generate $5.2 million of economic activity. Conservatively speaking, not all of this expenditure may occur in Carbon County. For this assessment, it was assumed that only $4.0 million will be spent in the County, with $1.2 million of goods and services purchased outside the County. All of these figures represent annual expenditures. Thus, after full operation is achieved, these numbers will remain reasonably level through the end of this decade.

E. SURGE IN COAL DEMAND SCENARIO

The forecast impacts in this chapter have been based on the assumption of continued stagnation in the coal industry with unemployment continuing at 9 percent. Should this assumption provide erroneous, then the impacts detailed below could be expected.

TABLE 27

IMPACTS IF ALL WORKERS IN-MIGRATE

	1983 Peak Construction			1985 Peak Operation		
	Direct	Indirect	Total	Direct	Indirect	Total
Workers	75	45	120	110	66	176
Single (24.6%)[a]	18	11	29	27	16	43
Married (75,4%)	57	34	91	83	50	133
Married, Would not Relocate Family (26.5%)[a]	15	9	24	22	13	35
Family Present	42	25	67	61	37	98
Household Size of (3.03)[b]	85	51	136	124	75	199
Total Population						
Impact	160	96	256	234	141	375
Adults	117	70	187	171	103	274
Children	43	26	69	63	38	101

[a]Mountain West Research, Inc. 1975.

[b]Average household size of 3.03 (to avoid double counting, 2.03 was multiplied by "family present"), 1980 U.S. Census, Carbon County, Utah.

Assuming that the coal market will improve dramatically, even to the extent that all of the Scofield Project employees must migrate to the area, as displayed on Table 27, then this project would be responsible for 6 percent of the growth increments through 1985. Combining direct and indirect slots, UCO would account for 11 percent of the growth in 1985. By 1990, UCO would be responsible for 4 percent of the increase from 1983 to 1990. It must be stressed that these percentages are true if and only if no Carbon County workers were available for hire.

In a study done by John Short & Associates, Inc., in 1980, 90 percent of Carbon County coal miners live in that county. Thus, assuming the coal surge scenario to be true, most of the workers would either originate in or move to Carbon County. With construction, the surge scenario could be accommodated through the use of transient housing. For operations, there would be a shortfall of approximately 100 dwelling units which would also indicate a shortage in water and sewer connections.

The coal market is currently soft. The events that may trigger a stronger local market are tied to decisions relating to the Intermountain Power Project, and to export coal decisions. Since these decisions have not as of yet been made, it is difficult to judge whether the surge scenario is applicable in the next few years. Thus, UCO suggests mitigation measures that offer flexibility to both the County and the company.

E. SOCIOECONOMIC MITIGATION MEASURES

Monitoring System

For the construction effort in 1983, local firms have submitted proposals to UCO to be subcontractors on various aspects of building the facilities and driving the slopes. Thus, UCO feels confident that most of the skilled and semi-skilled jobs will be performed by local companies. However, for both construction and operation, a monitoring system is proposed. Each new hire will be asked to complete the following questionnaire:

Name ______________________

1. I currently live in ______________________ (Name of Town) ______________________ (Zip Code)

2. I have lived there for ______ years (use months if less than 1 year)

3. Before living here, I lived in ______________________ (Name of Town) ______________ (Zip Code)

4. I (circle one) ... my ... (circle one)

I (circle one)		(circle one)
own	my	apartment
rent		condominium
lease		house
		mobile home or recreational vehicle

5. Previous Employer ______________________

   Location ______________________

6. In what town do you do most of your shopping? ______________

7. a. Marital Status: single, married (if divorced/separated, circle single)

b. Is your family currenty living with you? Yes___ No___

c. Number of children ______________________

d. Number of children in school ______________________

The results will be tabulated and available upon request.

From this questionnaire, UCO can assess the origin of their workforce as well as determine the settlement patterns of the in-migrants. Also, data on housing, family size and education are collected. From these specific data items, community infrastructure impacts can be calibrated.

Bus Transporation

In order to abide with the State and local decision to keep growth in Scofield to a minimum, workers will be bused from the Price-Helper area to the mine site. The bus route will originate in Price and will then proceed to Helper. The bus system is slated to originate in the Price-Helper area because of the Job Service data indicating this area to have the largest unemployed coal labor force in the County.

The bus system also serves as an internal monitor to determine when an insufficient labor force exists in the Price-Helper area. Any changes in the bus route will be discussed with both County officials and with State officials.

Communication

One of the more important aspects of ensuring continued County and State planning efforts is for industry to keep these officials abreast of the progress on the project. UCO has been discussing both the progress and at times, non-progress, of the Scofield Project with relevant officials. UCO proposes to continue to communicate the status of the project with these officials. Whether the means of communication consist of a quarterly progress report, or an in-person meeting (formal or ad hoc) should be discussed.

The purpose of the communication measure follows from much of the rapid energy development socioeconomic literature that suggests that local governments can be quite adaptive to change IF they are informed of schedules and any changes in project scope.

Banking

UCO proposes to use local financial institutions for their checking account. Use of local banks not only expedites cashing checks, but more importantly, the practice increases the amount of money that banks can loan out, particularly for new homes.

This report is intended to assist Carbon County and State officials in assessing the socioeconomic impact of the Scofield Project. UCO looks forward to discussing this report with relevant officials. For more information on other aspects of the Scofield Project, please consult the Mining and Reclamation Plan submitted to the Utah Division of Oil, Gas and Mining.

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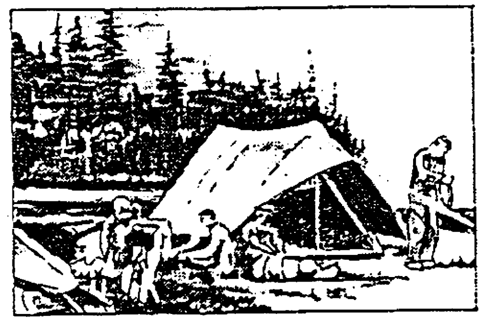
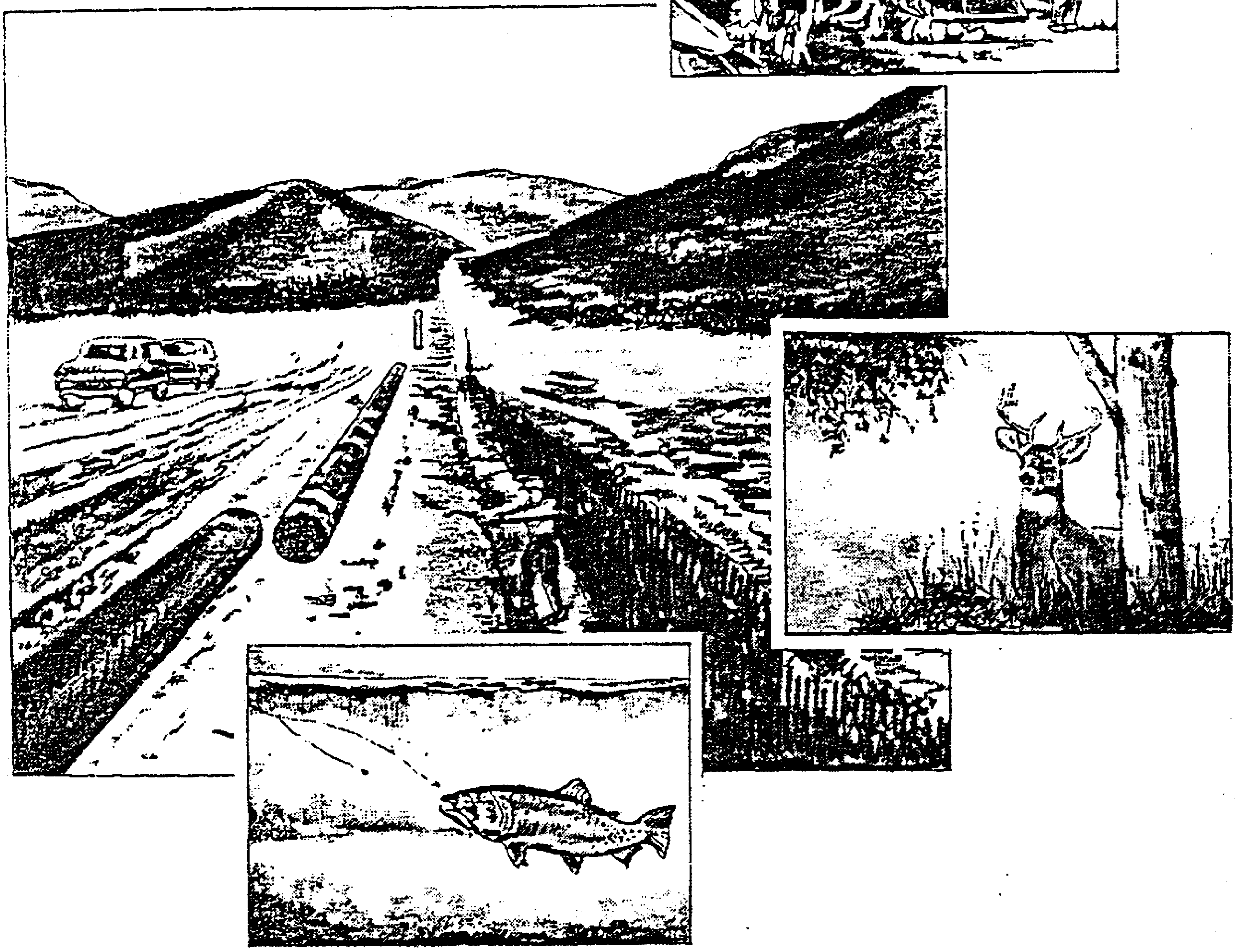
QUESTAR PIPELINE COMPANY'S
MAIN LINE No. 41
FINAL ENVIRONMENTAL IMPACT STATEMENT
DAMES & MOORE, 1990

Questar Pipeline Company's





Main Line No. 41
Reroute at Skyline Mine

Final Environmental Impact Statement

US Department of Agriculture
Forest Service, Manti-La Sal National Forest

JULY 1990
Dames & Moore

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NOISE

There are no established Federal, State, or local noise standards that apply to this area. Ambient noise consists of typical forest sounds and distant traffic on highways and roads. Ambient noise levels are estimated to be about 45 decibels (dBA), which is typical of such settings.

SOCIOECONOMICS

The area of influence for the proposed project includes Carbon, Emery, and Sanpete counties. The closest city of any size in this area is Price with a 1980 population of slightly more than 9,000.

Total baseline population is projected to be 627,869 for the three-county area of influence by the year 2000. There has been a net decline in population for both Carbon and Emery counties and an increase in population for Sanpete County from 1980 to 1988. All 3 counties have seen a rise and fall in their population base since 1960.

Demographics reveal a predominately white and native-born (to the region) population in the area, evenly split between male and female and somewhat younger, on average, than the State at large.

Carbon County has, by far, the strongest economy representing more than 50 percent of the total personal income in the three counties. Mining is the dominant earning factor in Carbon and Emery counties. Mining and transportation/utilities are the two dominant components of the economies in Carbon and Emery counties. Only in Sanpete County is there a significant farm component to the county economy.

Generally, the three-county area is experiencing an overall decline in its economic health according to the Utah Division of Business and Economic Development. Most employment activity is taking place in Carbon County.

Carbon County's nonfarm jobs in the second quarter of 1989 totaled 45 fewer than the previous year. The loss of jobs in coal mining (270 positions) was not offset by gains in services (110 positions), manufacturing (50 positions), and government (40 positions).

Emery County's nonfarm jobs increased by 50 positions over the same period in 1988. Most of these jobs were in heavy construction. Mining reported the only significant sector drop, losing 20 positions.

Sanpete County reported an increase of 260 positions in nonfarm jobs from the second quarter of 1982 to the second quarter of 1989. These jobs primarily were created by the construction of the new regional prison (which employs 215 workers). Manufacturing created 100 new jobs in food-products manufacturing.

From 1979 to 1986 average real output per Utah coal miner increased at an average rate of 7.6 percent per year because of increased use of longwall mining. This was higher than the national average of 6.97 percent and considerably higher than the period of 1969 to 1979 (0.96 percent per year for Utah and 0.49 percent per year for the United States).

Table 3-8 summarizes employment data in the area of influence for 1988 and 1989 during the period April through June. Government, especially local government, dominates in both Sanpete County and Carbon County. However, in Emery County mining is the largest employer. Mining provided 13 percent of the jobs in the three counties in 1989, which ranked it third ahead of services and behind government (first) and trades (second).

Nonagricultural jobs constitute over 88 percent of the total civilian labor force in Carbon and Emery counties for both 1988 and 1989. In Sanpete County the figure drops to 60 percent, reflecting a more significant agricultural sector than either Carbon or Emery counties. Unemployment in all three counties is high, but it is highest in Sanpete County.

Table 3-9 reveals that Carbon and Sanpete counties are only in fair fiscal condition and that Emery County is in poor fiscal condition. Net business creations in Emery County in 1986 was a loss of two. Carbon County lost six businesses in the same year and Sanpete County gained seven.

Mine Employment and Production

In 1988 the Skyline Mine operated by Utah Fuel expended $48,488,000 on mining operations. Tabulation of the distribution of these expenditures is presented in Table 3-10.

As of November 15, 1989 there were 251 people employed at the Skyline Mine. This is expected to increase to 300 by 1991, with continued planned expansion. The distribution of the work force is presented in Table 3-11.

The impact of Skyline's mining operations upon the local labor force is large. Maintaining this contribution to the local economy and developing a modest expansion of mine operations in 1991 are, according to the operator of the mine, closely tied to relocating Main Line No. 41.

Pipeline Construction

A description of methods that would be used to construct the pipeline is provided in Appendix A, Questar Pipeline's Preliminary Construction, Operation, and Maintenance Plan. Table 3-12 provides a list of pipeline acquisition, construction, reclamation, and annual maintenance cost estimates for each route.

Coal

Value - To determine the value of the coal beneath each of the proposed routes, the tonnages of recoverable coal estimated by the BLM were multiplied by $25.00 per ton, the average for State spot and long-term sales (refer to Table 4-3 in Chapter 4). The resulting figures are base values of the recoverable coal and do not reflect consideration of operating costs.

Royalties amounting to 8 percent of the value of Federal, mined coal are paid to the Federal government. Fifty percent of the 8 percent (which is 4 percent) is then disbursed to the State of Utah and local communities. All figures, both royalties and values, in

Table 4-3 are approximate. Royalties are paid exclusively to the owner when the mined coal is privately owned. Table 4-3 does not include royalties for private coal.

Prior Rights - The existing pipeline has been in place since 1953; whereas, the Skyline Mine permit has more recently been issued. The existing pipeline, a legitimate surface use, is protected from harm by Federal and State regulations and lease stipulations. It is the responsibility of Utah Fuel, the company whose mining activities would affect the existing pipeline, to ensure that it is not damaged by mining activities. Under the current situation, Utah Fuel is financially responsible for protection of the existing pipeline against damage caused by subsidence.

If a bypass pipeline is constructed on public land where no leases currently exist, but a lease is issued in the future, Questar Pipeline would have prior rights. If the mining company chooses to extract coal beneath the pipeline, the mining company would be responsible for ensuring the continued use and operation of the pipeline (as in the case of this project).

However, if a bypass pipeline is constructed on land where leaseholds or private ownerships exist coal owners or lessees would have prior rights. In such a case, Questar Pipeline would have to financially negotiate with the leaseholder or owner for the rights to the coal beneath the proposed pipeline. Otherwise, Questar Pipeline would face the potential of relocating again. Acquisition costs for both surface rights-of-way and coal have been estimated in Table 3-12. Segments 5/6, 8, and 9 in the Valley Camp Triangle; and 20, 21, and 22 along the Winter Quarters Route, and Segment 1 along the Gooseberry Route would cross leased or private coal.

The preference would be to select an unencumbered permanent location for the pipeline to avoid purchasing coal rights, future relocation, or conflict with mining activities.

TABLE 3-8
SELECTED LABOR MARKET DATA (APR-JUNE)

	CARBON			EMERY			SANPETE		
	1988	1989	% Chg	1988	1989	%Chg	1988	1989	% Chg
CIVILIAN Labor Force	8327	8233	-1.1	3426	3378	-1.4	6250	6490	3.8
Employed	7582	7536	-0.6	3089	3121	1.0	5490	5766	5.0
Unemployed	745	697	-6.4	337	257	-23.7	760	724	-4.7
% of Total	8.9	8.5		9.8	7.6		12.2	11.2	
TOTAL NON-AGRICULTURAL JOBS	7367	7322	-0.6	3368	3421	1.6	3739	3966	6.1
Mining	1482	1195	-19.4	946	922	-2.5	1	4	300.0
Contract Const.	158	172	8.9	118	166	40.7	140	215	53.6
Manufacturing	258	307	19.0	10	10	0.0	655	760	16.0
Trans, Comm. Utilities	376	394	4.8	807	802	-0.6	149	154	3.4
Trade	1621	1637	1.0	348	352	1.1	803	310	0.9
Fin, Ins, Real Estate	193	184	-4.7	47	45	-4.3	91	100	9.9
Service	1314	1427	8.6	285	281	-1.4	395	397	0.5
Government	1965	2006	2.1	807	843	4.5	1505	1526	1.4
Federal	182	189	3.8	46	47	2.2	84	89	6.0
State	477	500	4.8	62	64	3.2	514	525	2.1
Local	1306	1317	0.8	699	732	4.7	907	912	0.6

SOURCE: Job Service, Labor Market Information Report, Utah Department of Employment Security.

TABLE 3-9
ASSESSED VALUES AND REVENUES

	1960	1970	1980	1981	1982	1983	1984	1985	1986	1987	Growth (Decrease) '80-'87	Growth (Decrease) '86-'87
CARBON ($1,000)												
Assessed Valuation	100205	168200	531665	510500	575950	684,045	716245	709295	761044	742211	40%	<2.47%
Gross Taxable Sales		70149	174226	187169	248666	200950	182986	189857	178323	170424	<2.18%>	<4.42%
Per Capita Gross Tax Sales	0.00	4.45	7.78	8.10	10.08	8.20	7.72	8.11	7.75	7.61	<2.18%>	<1.80%:
Lodging Room Tax			1429.5	1742.7	1609.9	2022.2	1775.9	1715.5	1266.1	2078.0	45.36%	64.12%
EMERY ($1,000)												
Assessed Valuationa	52515	50940	946495	1104330	1169100	1402730	1445895	1388335	1484720	1547634	63.51%	4.23%
Gross Taxable Sales		5725	51159	80270	98471	58127	55173	46523	60390	42287	<17.34%>	<28.71%:
Per Capita Gross Tax Sales		1.11	4.41	6.63	7.57	4.44	4.45	3.94	5.12	3.65	<17.23%>	<29.97%:
Lodging Room Tax			736.7	541.1	769.0	703.3	742.3	747.4	618.6	584.5	<20.65%>	<5.51%:
SANPETE ($1,000)												
Assessed Value	62460	75610	252965	239065	249840	267380	296365	318650	335667	311316	23.06%	<7.25%.
Gross Taxable Sales		16055	46468	48378	47124	47582	53739	51934	51139	54334	16.92%	6.25%
Per Capita Gross Tax Sales		1.46	3.14	3.14	2.93	2.82	3.10	3.07	3.10	3.27	4.14%	5.48%
Lodging Room Tax			222.0	227.0	236.3	2094.9	248.3	239.2	256.5	300.7	35.45%	17.23%

SOURCE: General Economic Conditions: Southeast and Six County Regions, Division of Business and Economic Development, State of Utah.

TABLE 3-10
SKYLINE MINE EXPENDITURES, 1988

Wages & Benefits	$ 10,271,000
Federal, State & Local Taxes	9,444,000
Royalties	7,281,000
Additions Property, Plant & Equipment (excluding sales taxes listed above)	5,064,000
Operating Expenditures (including other assessments, operating supplies, fees and services not included in the above)	16,428,000
TOTAL	$ 48,488,000[1]

SOURCE: Memo from John M. Garr, Coastal States Energy Company 11/16/89

[1]Excluding interest payments or non-cash expenses such as depreciation.

TABLE 3-11
DISTRIBUTION OF SKYLINE MINE WORKFORCE

County	Number of Employees	Percent of Total	County: Total Workforce	County: Employed	County: Percent	County: Un-employed	Percent
Carbon	36	14.3	8660	8028	92.7	632	7.3
Emery	3	1.2	3620	3403	94.0	217	7.0
Salt Lake	4	1.6	363,430	351,073	96.6	12,357	3.4
Sanpete	135	53.8	6600	6032	91.4	568	8.6
Sevier	7	2.8	6550	6216	94.9	234	5.1
Utah	66	26.3	113,280	109,202	96.4	4078	3.6
TOTAL	251						

SOURCE: Memo from John Garr, Coastal States Energy Company, 11/16/89

TABLE 3-12
ESTIMATED ACQUISITION, CONSTRUCTION, RECLAMATION, AND MAINTENANCE COSTS BY ROUTE

Route	Acquisition	Construction and Reclamation	Annual Maintenance (entire route)
Alternative A - No Action	$ 0	$ 0	$ 24,300 *
Alternative B - Leave in Place, Full Extraction Mining	$ 0	$ 3,334,000 **	$ 146,650 (15-20 years)
Alternative C - Burnout Canyon Route			
(1)	$ 0	$ 2,197,000	$ 26,820
(2)	$ 0	$ 1,898,000	$ 27,180
(3)	$ 0	$ 2,953,000	$ 28,062
(4)	$ 0	$ 2,654,000	$ 28,220
Alternative D - Gooseberry Route	$ 4,612,800	$ 3,937,000	$ 30,060
Valley Camp Triangle Connectors			
(1)	$ 0	$ 240,500	$ 1,800
(2)	$ 2,400,000	$ 253,500	$ 1,620
(3)	$ 1,600,000	$ 214,500	$ 900
Alternative E - Winter Quarters Routes			
(1) (with Segments 19* and 23*)	$ 11,464,640	$ 4,141,600 ***	$ 36,630
(2) (with Segment 19*)	$ 6,264,000	$ 4,092,000	$ 36,000

* Does not include costs for repairs if subsidence should result from partial mining.

** Does not include cost to replace major sections of pipeline following complete subsidence, which could be as much as $1,479,000 following cessation of subsidence from each of 3 seams. Also does not include costs to remove redundant pipeline and reclaim disturbed areas at the conclusion of mining ($228,000).

*** Includes $60,000 for valve assemblies and piping to modify system to backflow gas to compressor station at Clear Creek.

Note: a: Cost estimates for reclamation are based on an average and do not reflect costs of any special mitigation measures or reclamation of abandoned right-of-way if pipeline is relocated.

b: Acquisition costs include acquisition of private and leased coal and surface right-of-way.

If construction of the selected proposed route (if any) is not completed by the Fall of 1990, an additional 3 to 9 mmt of recoverable coal could be lost. Unanticipated construction problems, strikes, adverse weather conditions, litigation, and surface right-of-way and coal acquisition could cause delays unless mitigated by using additional personnel and equipment.

Specific Descriptions

Alternative A - No Action - There would be no costs associated with construction or acquisition. Costs for annual maintenance of the existing pipeline is about $24,300.

As discussed previously, if the pipeline is left in place and fully protected from subsidence, Utah Fuel would be able to mine only up to one-third of the recoverable coal resources by full support mining leaving most of the recoverable coal unmined. There is an estimated 27.6 mmt of recoverable coal beneath this entire route with an estimated value of $690 million. Up to approximately $29.8 million in royalties to the Federal and State governments would not be realized if the pipeline is fully protected and the 14.9 mmt of coal under it are not mined. The loss of revenue generated by mining activities (i.e., wages, benefits, supplies, taxes, equipment) excluding royalties would amount to $291.4 million (based on extrapolated 1988 expenditures).

Alternative B - Leave in Place, Full Extraction Mining - Protecting the pipeline in place over the Skyline Mine permit area involves some element of risk such as the possibility of damage to the pipeline resulting in a stoppage of the natural gas flow and liability to those end users whose gas supply would be curtailed. If the pipeline were to fail during a time of year when access is relatively easy, the cost associated with the required repairs would be low but reestablishing service after interruption is estimated at $1 million.

Should a pipeline failure occur during the winter months it becomes questionable that service could be restored promptly. During a mild winter the large machinery required may be able to access much of the pipeline, but during harsh winter conditions it is virtually impossible. Service to customers could be interrupted for an extended period, potentially causing injury or death and placing virtually unlimited liability on the companies involved.

The costs below reflect the most likely case for protecting the pipeline in place on the Skyline Mine permit area. Costs for pipeline protection off the Skyline Mine permit area have not been estimated but could be of equal magnitude. There would be an up front cost for engineering, legal, FERC application and permits of $41,300.

Southern 1.65-mile Portion (overlying 3 minable coal seams) - Installation of the redundant line is projected to cost $1.3 million. The southern ends of the pipeline most likely would have to be replaced after each seam is mined. Questar Pipeline believes that the entire line would have to be replaced after all of the seams have been mined because the gas transmitting capacity of the pipeline would be decreased by stress. It would cost about $90,000 to remove the redundant line and reclaim the disturbed area. The total construction cost of a redundant pipeline for the southern portion would be $2.11 million.

Northern Portion - The northern portion within Skyline Mine's permit area is 2.6 miles long and would be undermined only once. Installation of the surface line and monitoring would cost $1.993 million. Replacement of the line at the end of the project is estimated at $759,000. Removal of the surface line and reclamation would be an additional $138,000. The total construction costs for the northern portion would be $2.89 million.

The total projected costs for the southern and northern sections (including engineering, legal permits, and FERC application) would be $5 million. Annual maintenance is projected at $146,650 for 15 to 20 years. There would be no costs for coal or surface right-of-way acquisition.

There are an estimated 27.6 mmt of recoverable coal beneath the entire route with an estimated value of $690 million and Federal royalties of $55.2 million. Approximately 12.7 mmt of recoverable coal worth $317.5 million and Federal royalties of $25.4 million would be impacted off the Skyline Mine permit area. Beneath the pipeline within the Skyline Mine permit area, there are an estimated 14.9 mmt of recoverable coal with a value of approximately $372.5 million and Federal royalties of $29.8 million.

An estimated 40 contract personnel and 10 company personnel would be required to complete the construction of the redundant pipeline. Actual construction would be let on a bid basis. Assuming that the successful bid is made by a union contractor, in which case 65 percent of the employees are estimated as local hires, the beneficial impacts upon the local labor force could be approximately $83,200. A nonunion contractor would most likely bring his own employees, but could hire locally. Assuming that the nonunion contractor hires 15 percent of his employees locally, the beneficial impact upon local wages could be approximately $19,200 for a 20-day contract period.

Those pipeline workers not living in the area would purchase food, other goods, and lodging locally. Estimated expenditures could range from $26,400 to $48,400 over the 40-day period.

Finally, during construction of the redundant pipeline, the contractor would be purchasing equipment usage locally. This includes rentals and fuel for heavy equipment. This is projected to range from $1,920 to $8,320.

Assuming a multiplier of 2.5, beneficial impact from construction of the redundant pipeline upon the local economies could range from $173,800 to $294,000.

Installation of the strain gauges would require 22 company personnel 90 days to complete. No contract employees would be needed. Wages would be approximately $108,900 and the beneficial impact upon local economies is estimated at $272,250.

Some additional coal could be lost or temporarily bypassed under Segment 18* to protect the pipeline if the redundant pipeline were not completed in 1990.

Alternative C - Burnout Canyon Routes - Relocation of Main Line No. 41 to Burnout Canyon Routes (1) or (2) would cost an estimated $2.2 million, $2.9 million for Burnout Canyon Route (3), and $2.6 million for Burnout Canyon Route (4). Any of the routes would require 40 to 60 days to complete. Most of the construction activity would be scheduled during the third quarter of the year so as to minimize impact upon the environment. An estimated 50 to 60 construction personnel and 12 to 15 company personnel would be required to complete the work. Actual construction would be let on a bid basis to a private contractor.

Total hourly wages to be spent during construction are estimated to range from $320,000 to $576,000 using a rate of $20.00 per hour for 50 employees working 40 days with up to 60 employees working 60 days. Assuming that the successful bid is made by a union contractor, in which case as estimated 65 percent of the employees would be local hires, the beneficial impacts upon the local labor force could range from $208,000 to a high of $374,000. A nonunion contractor would probably bring his own employees, but could hire locally, though probably considerably fewer than a union contractor. Assuming that the nonunion contractor hires 15 percent of his employees locally, the beneficial impact upon local wages would range from almost $50,000 for a 40-day contract period to $86,000 for a 60-day contract period.

Questar Pipeline estimates that 12 to 15 company employees would temporarily relocate to the job site during construction. Those pipeline workers not living in the area, both hourly and company employees, would purchase food, other goods, and lodging locally. For the union contractor (hired locally) the estimated range of expenditures is about $50,000 to almost $80,000 over the 40 to 60 day life of the project. This also assumes 15 company personnel living in the area during construction. The impact is more considerable for the nonunion contractor who is bringing in most of his labor. The range is $127,000 up to $218,000, including company personnel.

Finally, during the construction of the pipeline, the contractor would be purchasing equipment usage locally. This includes rentals and fuel for heavy equipment. This is projected to range from a low of $32,000 to a high of almost $67,000 over the duration of the construction.

Local expenditures by the construction contractor could range from a low of $290,000 to a high of $514,000 for a union contractor. For a nonunion contractor the range is $209,000 to $364,000. Assuming a multiplier of 2.5, this indicates that the beneficial impact upon the local economies could range from $522,500 to $1.235 million over the life of the project.

Annual maintenance costs would be approximately $26,820. Construction, reclamation, and maintenance costs and other impacts for future pipeline relocation over unleased or unmined coal lands have not been estimated, but could be of similar magnitude. There would be no coal or surface right-of-way acquisition costs.

There are an estimated 14.7 mmt of recoverable coal beneath Burnout Canyon Routes (1) and (3) with an estimated value of $367.5 million and Federal royalties of $29.4 million. New pipeline would affect an estimated 2.6 mmt of recoverable coal with a value of $65 million and Federal royalties of $5.2 million.

Beneath the entire Burnout Canyon Routes (2) and (4), there are an estimated 17.4 mmt of recoverable coal with an estimated value of $435 million and Federal royalties of $34.8 million. New pipeline would affect an estimated 2.9 mmt of recoverable coal with an estimated value of $72.5 million and Federal royalties of $5.8 million.

Some additional coal could be lost or temporarily bypassed under Segment 18* if the pipeline is not relocated in 1990.

Valley Camp Triangle Connectors (1) through (3) - The estimated 2.1 mmt of recoverable coal beneath the entire Connector (1) has a value of $52.5 million and Federal royalties of $4.2 million. New pipeline would affect 1.5 mmt of recoverable coal with a value of $37.5 million and Federal royalties of $3 million. There would be no costs for acquisition of coal or surface rights-of-way.

The estimated 2.1 mmt of recoverable coal beneath entire Connector (2) has a value of $52.5 million and Federal royalties of $4.2 million. New pipeline would affect 1.8 mmt of recoverable coal with a value of $45 million and Federal royalties of $3.6 million. Coal acquisition costs are estimated at $2.4 million.

The estimated 1.4 mmt of recoverable coal beneath entire Connector (3) has a value of $35 million and Federal royalties of $2.8 million. New pipeline would affect 1.4 mmt of recoverable coal with a value of $35 million and Federal royalties of $2.8 million. Coal acquisition costs are estimated at $1.6 million.

Gooseberry and Winter Quarters Routes - Both routes would have larger beneficial economic impacts due to construction upon the local economy. Capital expenditures would range from $3.9 million to $4.14 million for construction. Duration of construction for both alternatives would extend beyond the 40 to 60 days for the other alternatives unless additional crews and equipment are used. In addition, both of the longer alternatives would cross private lands requiring negotiation or condemnation proceedings, factors that would potentially create large time delays.

Employment of 151 new individuals as planned by Skyline Mine to increase production from 3.5 million to 5 million tons per year could be delayed for a minimum of 1 year (1992-1993).

During construction of either of the two alternatives, an estimated $640,000 to $864,000 in total hourly wages could be expended. This assumes an 80- to 90-day construction period using one crew as described under Alternative C. A union contractor could generate between $416,000 to as high as $562,000 in wages. A nonunion contractor could expend between $96,000 and $130,000 in local wages.

Purchase of food, other goods, and lodging locally could range from $101,000 to $110,000 for a union contracting company. These expenditures would increase considerably should the bid for pipeline construction be awarded to a nonunion contractor. A low of $255,000 to a high of $327,000 could be expended if a very high percentage of pipeline personnel relocated to the area during construction.

Local expenditures on equipment usage would also increase for these longer route alternatives. The range of expenditures is estimated to be $64,000 to $86,000.

It is estimated that a union contractor would contribute between $581,000 and $767,000 to the local economy. A nonunion contractor would expend between $415,000 and $543,000 locally. Assuming a multiplier of 2.5, these data suggest a beneficial impact upon the local economy ranging from $1,037,500 to $1,917,500 over the life of the construction project.

Annual maintenance costs would be $30,060 for the entire Gooseberry Route, $36,360 for the entire Winter Quarters Route (1) including Segments 19* and 23* that could not be abandoned, and $36,000 for the entire Winter Quarters Route (2) including Segment 19* that could not be abandoned.

The costs for construction, reclamation, and maintenance, and other impacts for any future pipeline relocation over unleased or unmined coal lands have not been estimated, but could be similar in magnitude.

Acquisition costs, including costs to acquire rights to private and leased coal and surface rights-of-way, are estimated at $4,612,800 for the Gooseberry Route, $11,464,640 for Winter Quarters Route (1), and $6,264,000 for Winter Quarters Route (2). Beneath the entire Gooseberry Route there are an estimated 11.8 mmt of recoverable coal with an estimated value of $295 million and Federal royalties of $19.0 million. Beneath the area of proposed new pipeline there are an estimated 9.6 mmt of recoverable coal with a value of $240 million and Federal royalties of $14.6 million.

Beneath the entire Winter Quarters Route (1) including Segments 19* and 23* there are an estimated 24.7 mmt of recoverable coal with an estimated value of $617.5 million and Federal royalties of $42.4 million. Beneath the area of proposed new pipeline there are an estimated 17.4 mmt of recoverable coal with a value of $435 million and Federal royalties of $27.8 million.

Beneath the entire Winter Quarters Route (2) including associated Segment 19* there are an estimated 18.9 mmt of recoverable coal with a value of $472.5 million and Federal royalties of $29.2 million. Beneath the area of proposed new pipeline there are an estimated 11.6 mmt of recoverable coal with a value of $290 million and Federal royalties of $14.6 million.

Some additional coal could be lost or temporarily bypassed under Segment 18* if relocation of the pipeline is not completed in 1990.

Mine Employment and Production

Utah Fuel mined 2.263 million tons of coal in 1988 and 2.969 million tons in 1989. Its plans call for increasing this to 3.48 million tons in 1990. The mine is designed to produce at a rate of 5 million tons per year, a goal Utah Fuel plans to reach in the near future. Holding rates of expenditures constant to output, the Skyline Mine, at 5 million tons of production per year, could generate almost $90 million in expenditures per year in constant dollars. As 70 percent of the mine employees reside in Sanpete, Carbon and Emery counties, the impact of mine operations upon the local economy is important. Roughly $7 million in wages and benefits now stay in the 3-county area; this could increase to $13 million in constant dollars with full production. Assuming a multiplier of 2.5, the annual impact upon the local economies of wages only could amount to $32.5 million once planned levels of mining are attained.

The loss of revenue resulting from a reduction or discontinuation of mining activities (i.e. wages, benefits, supplies, equipment, taxes) with royalties excluded would amount to $2.914 million based on extrapolating 1988 expenditures (see Table 3-10).

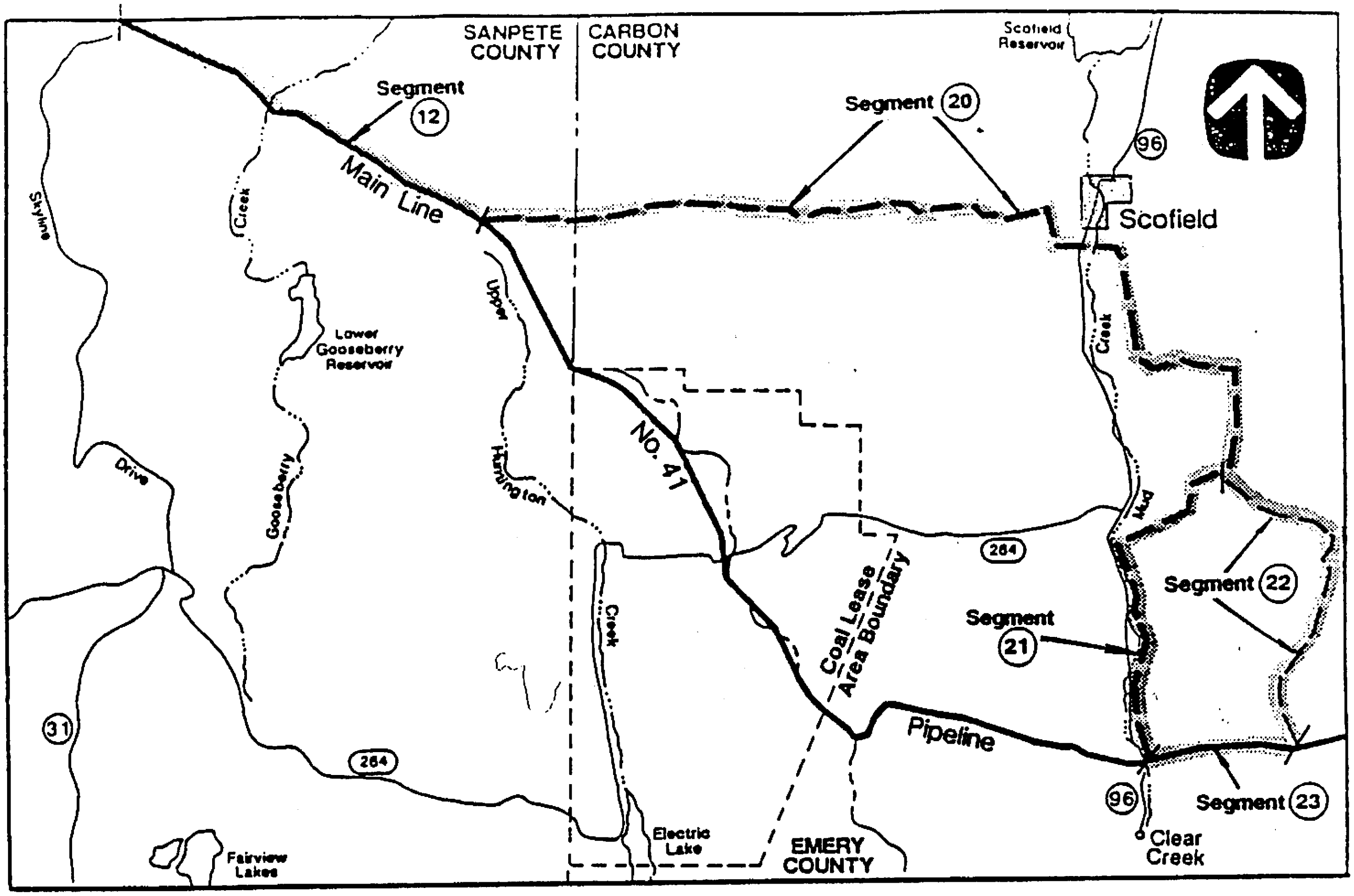

FIGURE B-4. THE WINTER QUARTERS ROUTE

Segments 12*, 20, 21, 23*; variation Segment 22; associated Segment 19*

Segment 12* (3.7 miles in length) is part of the existing pipeline and for purpose of this study begins in the northwest quarter of Section 25, T.12 S., R.5 E. (SLM) at the headward side of the Cabin Hollow Creek Drainage. The pipeline trends southeasterly from near the junction of Skyline Drive and an unimproved two-track road, the latter of which runs adjacent to the pipeline for one-half mile before turning south. One-third mile thereafter, the pipeline begins descending some 1,000 feet in elevation over the next mile to the crossing at Gooseberry Creek, then ascends nearly 1,400 feet over the remaining 2.2 miles.

An unimproved two-track road roughly parallels the pipeline for some 2.6 miles beginning about 0.4 mile west of the Gooseberry Creek crossing to the eastern end of Segment 12*. The roadway crosses the pipeline at numerous locations along the segment.

Segment 20 (9.1 miles in length) trends east/west for approximately two-thirds of its proposed length along the upland reaches of Winter Quarters Ridge before descending just west of Scofield to crossings situated at an unimproved two-track road, Winter Quarters Creek and Mud Creek. After skirting the southern corporate limits of Scofield, the segment turns southward just east of Mud Creek atop the ridgeline separating Pleasant Valley on the west and UP Canyon to the east for the distance of 1.1 miles. At

that point, the proposed segment turns east for .75 mile and then south for the remaining distance.

An unimproved two-track road would run adjacent to the proposed pipeline segment from the vicinity of Scofield to the junction with either Segment 21 or 22.

Segment 21 (3.1 miles in length) descends the ridgeline north of Broads Canyon crossing along its course 2 unimproved roads and the stream at the mouth of Broads Canyon before reaching and crossing Mud Creek. The proposed pipeline segment then runs upstream adjacent to and west of Mud Creek until the mouth of Slaughter House Canyon where the pipeline crosses to the east side of the creek near an existing highway culvert. The segment then continues upstream to connect with the existing pipeline just east of Utah State Highway 96.

Segment 23* (1.3 miles in length), part of the existing pipeline, differs in elevation by over 1,200 feet between the western end (lowest) and eastern end (highest) of the segment. The pipeline follows the ridgeline between Boneyard Canyon on the north and Magazine Canyon to the south and continues eastward to a topographic feature referred to as "The Elbow". This location marks the eastern extent of the proposed pipeline reroute project and is situated in the southwestern quarter of Section 27, T.13 S., R.7 E. (SLM).

Segment 22 (3.3 miles in length) is an eastern alternative for the Winter Quarters Route. The proposed segment instead of descending along the ridgeline of Broads Canyon like Segment 21, sidles eastward and southward along the upper reaches of Broads Canyon before rejoining the existing pipeline at "The Elbow". Unimproved two-track roads exist adjacent to the proposed pipeline alignment.

Segment 19* (2.8 miles of existing pipeline) is not a part of either Winter Quarters Routes (1) or (2). However, if either of these routes is selected, the existing pipeline of Segment 19* cannot be abandoned as it is needed to supply gas to a tap line that joins Main Line No. 41 at the western terminus of Segment 19*. Because this segment cannot be abandoned, the environmental resources are addressed along Segment 19* not as part of the routes, but as a segment associated with the route.

The first one-half mile on the western end of Segment 19* trends northeasterly before turning in a southeasterly direction. The southeastern component follows the ridgeline between Slaughter House Canyon on the north and Boardinghouse Canyon to the south and crosses and runs parallel to a unimproved road for nearly 0.5 mile at the western end of the component. At the eastern end of the segment, the topography descends nearly 1,100 feet over the last 0.5 mile, crossing State Highway 96 and Mud Creek near the junction with Segment 23*.

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Winter Quarters Canyon
Data Adequacy

October 1992

COMMUNITY INFRASTRUCTURE & SOCIO-ECONOMICS SKYLINE MINES MINING AND RECLAMATION PLAN VOLUME 1, 1992

SKYLINE MINES

MINING AND RECLAMATION PLAN

COASTAL STATES ENERGY COMPAN

1992

VOLUME 1

2.13 COMMUNITY INFRASTRUCTURE AND SOCIO-ECONOMICS

Numerous significant changes have occurred in the Skyline Mines community infrastructure and socio-economic service areas since the Permittee filed its Mining and Reclamation and permit application in 1979. These changes and their effects are reflected in the balance of this renewal update report.

This report clearly illustrates that the operation of the Permittee's Skyline Mines have had no negative socio-economic impacts on the community infrastructure of the service areas of Carbon, Emery, Sanpete, and Utah counties. In fact, the report illustrates that the development and operation of the Skyline Mines has been quite beneficial and has provided support to areas involved, and that planned future growth will have no adverse effects on the four county service area.

In general, dramatic changes have taken place in the number of coal mines in operation and the resultant work force reduction. Several changes in coal mine ownership have also occurred. One coal mining operation has had several mine fires, which significantly impacted the Skyline Mines' service areas. All of these changes have impacted the general economy of the 4 county area to different degrees, and this update report will address these items in further detail.

The original survey done by the Kaiser Engineers in August 1979 addressed the capability of the communities around the Coastal Permittee's Skyline Mines being able to accommodate the needs of Utah Fuel Company employees.

Our five year operational experience has shown that the communities of Carbon, Emery, Sanpete, and Utah counties have had and do have the abilities to provide the necessary infrastructure, i.e., community services such as water, sewage systems, housing, schools, recreation, medical care, land, and commercial facilities.

2.13.1 Service Area

The Skyline Mines have a rather large service area. Conceptually the service area can be viewed as two concentric circles. The inner circle is primary to the Skyline Mines; the outer is secondary.

The primary area contains those communities that lie within a 45 minute commute, and therefore are most likely to receive the largest influx of new residents seeking employment at Skyline. The secondary service area consists of those communities requiring over 45 minutes commute time to the mine. These communities are listed on the following page by service area category.

The newly constructed Eccles Canyon road (part of SR-264) was completed with final paving by the end of the 1986 construction period. The construction of this highway has facilitated employee travel to the work area and also has provided a safe and short, year-round connecting route between Carbon, Emery, and Sanpete counties.

greater distances and remain dependable, capable and safe workers.

Skyline employees are bussed daily from Carbon, Sanpete, and Utah counties. A few employees commute to work from Sevier and Salt Lake counties.

<u>PRIMARY SERVICE AREA</u>

<u>Pleasant Valley</u>	<u>Sanpete Valley</u>	<u>Carbon County</u>
Scofield (8 min.)	Fairview (30 min.)	Price (50 min.)
Clear Creek (8 min.)	Mt. Pleasant (37 min.)	Helper (44 min.)
	Spring City (44 min.)	
	Moroni (44 min.)	

SECONDARY SERVICE AREA

Carbon County	Emery County	Sanpete County
Wellington	Cleveland	Ephraim
Sunnyside	Orangeville	Manti
East Carbon	Castle Dale	Gunnison
Hiawatha	Ferron	Centerfield
	Huntington	Fountain Green
		Milburn
Juab County	Utah County	Sterling
Nephi	Payson	Wales
	Spanish Fork	
	Santaquin	
	Mapleton	
	Salem	
	Springville	

Earlier employment predictions indicated that some permanent residents from these secondary service area communities will commute to the Skyline mine for employment, but newcomers will not settle so far from the mine. Experience with other mines in the geographical area indicated that a 30 to 40 minute commute over 40 miles or less represents the maximum that miners can be expected to commute and still maintain a high degree of reliability. The Permittee's experience at Skyline has shown that with company bussing being provided, employees will travel greater distances and remain dependable, capable and safe workers.

2.13.2 Growth Capability

Experience over the past five years has shown that the service area communities have had and do have more than adequate infrastructure to accommodate the relatively small growth now anticipated at the Skyline Mines. See Table 2.13-1, Growth Capability Summary.

TABLE 2.13-1

GROWTH CAPABILITY SUMMARY

Services (Current Status) / Community	Water	Sewer	Land For Expansion	Schools	Hospital	Housing	Commercial Facilities
Scofield	New System	New System	Yes	None	None	Small Surplus	Minimal
Fairview	Upgraded	Adequate	Yes	Unused Capacity	None	Surplus	Partial
Mt. Pleasant	Upgraded	Upgraded	Yes	Unused Capacity	Yes	Surplus	Full Convenience
Spring City	Upgraded	Adequate	Yes	Unused Capacity	None	Small Surplus	Partial
Price	Adequate	Adequate	Yes	Adequate	Yes	Significant Surplus	Full Convenience
Helper	Adequate	Adequate	Yes	Adequate	None	Significant Surplus	Partial
Moroni	Upgraded	Adequate	Yes	Unused Capacity	None	Surplus	Partial

Communities in Carbon, Emery, Sanpete and Utah counties have upgraded and are upgrading their infrastructure systems to better serve the needs of their residents. Because of anticipated growth in the late 70's and early 80's, all of the service area counties upgraded or replaced many of their outdated community infrastructure facilities. With the decline in energy demands and resultant reductions in the work force, many of the communities now find themselves with surplus service capability.

2.13.3 Labor Force

At the time the Skyline Mines were being planned and initial construction started, there was a much greater demand for employees than there is at the present time.

Employment in the coal mining service areas has declined drastically. Sanpete, Carbon and Emery counties have a current combined unemployment of 9.5%. Utah county had extensive layoffs at the U.S. Steel Geneva plant. Since the Geneva plant has resumed full operation, unemployment levels in Utah County have improved slightly.

Table 2.13-2, 1988 Work Force - Unemployment Status, indicates for the above four county area a total of 6,180 unemployed workers, or 5.0% of the total work force, available for employment.

The current distribution of manpower, Table 2.13-3, shows the manpower distribution levels and percentage employed at the Permittee's Skyline Mines by county and respective communities for the year 1988.

Tables 2.13-4, 2.13-5, 2.13-6, 2.13-7 and 2.13-8 reflect similar manpower distribution levels for the past four years, 1982 through 1986.

These tables generally reflect the uneveness of the demand for coal over the past five years that has affected the Skyline

Mines' development. Earlier predictions indicated rapid escalation of manpower levels, gradually reaching approximately 900 employees by 1991. Instead, manpower levels have increased only gradually, with intermittent reductions, primarily in the construction work force, to the current maximum of 232 employees as of December 30, 1988.

Table 2.13-9, showing projected manpower levels through the year 1991, indicates maximum employment figures to reach only 299 total employees during that five year period rather than the original projection of 900. Manpower figures probably will not increase beyond the 300 level, based on current production projections.

Table 2.13-8 also projects the percentage breakdown by county where Skyline employees will reside, based on past experience.

Kaiser Engineers review of community infrastructure and socio-economic aspects final report on the Skyline Mines projected a manning table for Pleasant Valley mines that indicated a combined total of 1,420 employees for the Skyline Mines and the neighboring Valley Camp mining operation. Table 2.13-9 reflects the actual employment numbers and manpower projections to the year 1991 for these two mining operations in the Pleasant Valley area. Projections for the years 1987 through 1991 are based on actual known projected coal demands for both mining operations and reflect as near as possible actual manpower needs in the next 5 year period.

Table 2.13-10 also indicates Valley Camp of Utah, Inc's present manpower residence locations showing a significant difference from the projections reflected in the Kaiser Engineers report of 1979.

These changes in manpower residence locations indicate workers are coming from communities that are capable of providing more and better services, and thus are even further reducing community impacts.

TABLE 2.13-2

1988 WORKFORCE - UNEMPLOYMENT STATUS

COUNTY	CURRENT WORKFORCE *	PERCENT UNEMPLOYED	NO. UNEMPLOYED
CARBON	8,280	8.5	700
EMERY	3,550	9.3	330
SANPETE	6,190	11.1	690
UTAH	104,940	4.3	4,460

Total Unemployed 6,180

* Current work force is comprised of employed workers and unemployed workers available for work as of December 30, 1988.

TABLE 2.13-3

MANPOWER DISTRIBUTION - 1988

UTAH COUNTY		PERCENT
Mapleton	2	0.86
Orem	5	2.16
Payson	7	3.02
Pleasant Grove	1	0.43
Provo	3	1.29
Salem	7	3.02
Santaquin	1	0.43
Spanish Fork	23	9.91
Springville	9	3.88
Benjamin	1	0.43
Elkridge	1	0.43
Lindon	1	0.43
Goshen	1	0.43
	62	26.72
CARBON COUNTY		
Helper	3	1.29
Price	22	9.48
Scofield	1	0.43
Kenilworth	1	0.43
Wellington	4	1.72
East Carbon	1	0.43
	32	13.79
EMERY COUNTY		
Ferron	1	0.43
Castle Dale	1	0.43
Emery	1	0.43
Huntington	1	0.43
	4	1.72

SANPETE COUNTY		PERCENT
Centerfield	4	1.72
Chester	1	0.43
Ephraim	8	3.45
Fairview	28	12.07
Fayette	1	0.43
Fountain Green	11	4.74
Gunnison	6	2.59
Manti	13	5.60
Mayfield	2	0.86
Moroni	10	4.31
Mt. Pleasant	30	12.93
Spring City	9	3.88
Sterling	1	0.43
Wales	2	0.86
Indianola	1	0.43
	127	54.74
SEVIER COUNTY		
Aurora	1	0.43
Glenwood	1	0.43
Richfield	1	0.43
Salina	1	0.43
	4	1.72
SALT LAKE COUNTY		
Sandy	2	0.86
West Jordan	1	0.43
	3	1.29

TOTAL MANPOWER = 232

TABLE 2.13-4

MANPOWER DISTRIBUTION - 1986

UTAH COUNTY		PERCENT	SANPETE COUNTY		PERCENT
Mapleton	2	1.27	Centerfield	1	0.63
Orem	5	3.16	Chester	2	1.27
Payson	3	1.90	Ephraim	5	3.16
Pleasant Grove	1	0.63	Fairview	22	13.92
Provo	3	1.90	Fayette	1	0.63
Salem	2	1.27	Fountain Green	6	3.80
Santaquin	2	1.27	Gunnison	7	4.43
Spanish Fork	15	9.49	Manti	10	6.33
Springville	8	5.06	Mayfield	1	0.63
	41	25.95	Moroni	7	4.43
CARBON COUNTY			Mt. Pleasant	13	8.23
Helper	1	0.63	Spring City	7	4.43
Price	13	8.23	Sterling	1	0.63
Scofield	1	0.63	Wales	1	0.63
	15	9.49		84	53.16
EMERY COUNTY			SEVIER COUNTY *		
Ferron	1	0.63	Aurora	4	2.53
	1	0.63	Glenwood	2	1.27
SALT LAKE COUNTY			Richfield	3	1.90
Sandy	1	0.63	Salina	7	4.43
	1	0.63		16	10.13

TOTAL MANPOWER = 158

* Employees presently residing in Sevier County are recent transfers from Coastal States Energy Company's Southern Utah Fuel Company mine located in Sevier County, Utah, an it is assumed they will relocate in one or more of the counties closer to the Permittee's Skyline Mines.

TABLE 2.13-5

MANPOWER DISTRIBUTION - 1985

SANPETE COUNTY		PERCENT
Chester	2	1.80
Ephraim	4	3.60
Fairview	19	17.12
Fountain Green	4	3.60
Gunnison	1	0.90
Manti	6	5.41
Mayfield	1	0.90
Moroni	6	5.41
Mt. Pleasant	9	8.11
Spring City	5	4.50
Wales	2	1.80
	--	-----
	59	53.15

CARBON COUNTY		
Price	8	7.21
Helper	1	0.90
Scofield	1	0.90
	--	-----
	10	9.01

UTAH COUNTY		PERCENT
Mapleton	1	0.90
Orem	5	4.50
Payson	2	1.80
Pleasant Grove	1	0.90
Provo	3	2.70
Salem	2	1.80
Santaquin	2	1.80
Spanish Fork	16	14.41
Springville	7	6.31
	--	-----
	39	35.14

SEVIER COUNTY		
Salina	1	0.90
Aurora	1	0.90
	--	-----
	2	1.80

SALT LAKE COUNTY		
Sandy	1	0.90
	--	-----
	1	0.90

TOTAL MANPOWER = 111

TABLE 2.13-6

MANPOWER DISTRIBUTION - 1984

UTAH COUNTY		PERCENT
American Fork	1	1.03
Mapleton	1	1.03
Orem	3	3.09
Payson	2	2.06
Pleasant Grove	1	1.03
Provo	3	3.09
Salem	1	1.03
Santaquin	2	2.06
Spanish Fork	15	15.46
Springville	6	6.19
	35	36.08
CARBON COUNTY		
Price	6	6.19
Helper	1	1.03
Wellington	1	1.03
East Carbon	1	1.03
	9	9.28
SANPETE COUNTY		
Chester	2	2.06
Ephraim	3	3.09
Fairview	18	18.56
Fountain Green	4	4.12
Manti	5	5.15
Mayfield	1	1.03
Moroni	5	5.15
Mt. Pleasant	8	8.25
Spring City	5	5.15
Wales	2	2.06
	53	54.64

TOTAL MANPOWER = 97

TABLE 2.13-7

MANPOWER DISTRIBUTION - 1983

UTAH COUNTY		PERCENT
Mapleton	2	2.08
Orem	2	2.08
Payson	2	2.08
Pleasant Grove	2	2.08
Provo	3	3.13
Salem	1	1.04
Santaquin	1	1.04
Spanish Fork	12	12.50
Springville	7	7.29
	32	33.33
CARBON COUNTY		
Price	9	9.38
Helper	1	1.04
	10	10.42
SANPETE COUNTY		
Chester	2	2.08
Ephraim	3	3.13
Fairview	20	20.83
Fountain Green	3	3.13
Manti	6	6.25
Mayfield	1	1.04
Moroni	6	6.25
Mt. Pleasant	8	8.33
Spring City	5	5.21
	54	56.25

TOTAL MANPOWER = 96

TABLE 2.13-8

MANPOWER DISTRIBUTION - 1982

		PERCENT
UTAH COUNTY		
Lehi	1	0.87
Mapleton	2	1.74
Orem	2	1.74
Payson	2	1.74
Pleasant Grove	3	2.61
Provo	5	4.35
Salem	1	0.87
Santaquin	1	0.87
Spanish Fork	15	13.04
Springville	10	8.70
	42	36.52
CARBON COUNTY		
Price	9	7.83
Helper	2	1.74
East Carbon	1	0.87
	12	10.43
SANPETE COUNTY		
Chester	2	1.74
Ephraim	3	2.61
Fairview	25	21.74
Fountain Green	3	2.61
Manti	6	5.22
Mayfield	1	0.87
Moroni	6	5.22
Mt. Pleasant	10	8.70
Spring City	5	4.35
	61	53.04

TOTAL MANPOWER = 115

TABLE 2.13-9

PROJECTED MANPOWER LEVELS

1989 THROUGH 1991

1989	1990	1991
253	299	337

PROJECTED MANPOWER RESIDENTIAL PATTERNS BY COUNTY *

COUNTIES	1989 no.	1990 no.	1991 no.
Carbon	46	54	61
Utah	71	84	95
Sanpete	134	158	178
Other	3	3	3
	---	---	---
TOTALS	253	299	337

* Projections based on previous employee history

Early projections of coal mine development in the Carbon/Emery area have proven to be incorrect and far in excess of actual existing conditions.

Table 2.13-11, which compares the projected mines to open on Federal land prior to 1985 to the current status, clearly illustrates that projections for a "booming" coal industry in the area were overly optimistic. Seven mines were projected to be operational with a combined annual production of 13.1 million tons, and total employment of 3,348 employees. Only three of the seven mines are in operation, producing only 3.70 MTPY and employing only 378 people of the projected 3,348, 2,970 less than projected.

It should also be noted that Table 2.13-10 did not contain the names of three other potential coal mine operations in the Pleasant Valley area. They were Blazon Mining Company, Aletha Mining Company, and UCO Mining Company. Blazon Mining Company did go into production for a brief period of time and then permanently closed their mine. Neither Aletha Mining Company nor UCO Mining Company went beyond the planning stages before reduced coal demand cancelled their project.

During the five year period from 1981-1985, 21 mining companies were classified as operating or potential operating mining companies. Of those 21 operating, eight are now shut down, two never become viable operations, three shut down during 1982-1983-1984, one is operating but facing a closure order, and UP&L's Wilberg (Emery) mine is closed due to a mine fire.

This summary clearly illustrates the instability and excess available work force of the Utah coal mining industry during the past five years, and further supports the premise that the Permittee's Skyline Mines' limited manpower needs have not negatively impacted, but perhaps have benefited, the service areas of Carbon, Emery, Sanpete and Utah Counties.

TABLE 2.13-10

MANNING TABLE FOR PLEASANT VALLEY MINES

Mine Year	82	83	84	85	86	87	88	89	90	91
Utah Fuel Company Employees	115	96	97	111	158	180	230	280	330	330
Valley Camp of Utah Inc Employees	245	216	181	165	165	165	165	165	165	165
TOTAL	360	312	278	276	323	345	395	445	495	495

The management at Valley Camp of Utah, Inc. reports that the present residence locations have changed from 1979 to the present as follows:

Communities	1979	1986
From Scofield	30%	13%
From Price/Helper	50%	37%
From Sanpete Valley	20%	28%
From Utah County		22%

TABLE 2.13-11

COMPARISON OF PROJECTED MINES TO OPEN ON FEDERAL LAND
PRIOR TO 1985
AND THE CURRENT STATUS

MINE NAME OPERATOR LOCATION	PROJECTED M.T.P.Y (1990 est.)	CURRENT M.T.P.Y	PROJECTED EMPLOYMENT	CURRENT EMPLOYMENT
"B" CANYON U.S. STEEL Near Sunnyside	1.0	Undeveloped	280	0
FISH CREEK & DUGOUT CANYON P G and E Near Wellington	3.2	Undeveloped	896	0
DEADMAN'S MINE AMCA RESOURCE 10 miles east of Kenilworth	1.0	Operating .65	280	56
SKYLINE MINES COASTAL STATES Near Scofield	4.0	Operating 1.75	800	157
BELINA #2 & O'CONNOR VALLEY CAMP Near Scofield	2.4	Belina #2 on standby .75	672	165
MINE #1 MT. STATES RESOURCES 20 miles south of Emery	.5	Undeveloped	140	0
SKUMPAH CANYON ENERGY RESOURCES GROUP 20 miles east of Emery	1.0	Undeveloped	280	0
TOTALS	13.1	2.20	3,348	378*

* 2,970 fewer employees than predicted earlier

TABLE 2.13-12

MINING COMPANY MANPOWER NEEDS
COMPARISON 1981 - 1985

COMPANY	MANPOWER NUMBERS 1981	1982	1983	1984	1985	MINE STATUS
Aletha	1	1	0	0	0	Inactive
Beaver Creek	325	180	110	140	121	Operating
Blackhawk				30	30	Shut Down
Blazon	37	37	0	0	0	Shut Down
Canberra	15	15	0	0	0	Shut Down
Coastal States SUFCo	317	306	306	296	267	Operating
Utah Fuel Co. Skyline	126	86	86	98	101	Operating
Coop	50	50	40	33	33	Operating
Consolidation	231	17	17	17	111	Operational Shut down 82-84
Emery	1740	1010	1050	760	869	Operating
Genwall	1	1	1	24	24	Operating, but under closure Order
Kaiser	265	0	0	96	312	Operating Shut down 82-83
Plateau	380	220	238	222	234	Operating
Price River (Castle Gate)	560	169	165	145	50	Shut down
Soldier Creek	140	88	90	76	76	Operating
Sunedco	2	1	1	1	1	Inactive
Tower (Andelex)	73	23	23	30	30	Operating
Train Mountain	60	25	25	37	29	Operating
UCO/Std. Metals	7	7	0	0	0	Inactive
U S Fuel	375	400	285	291	228	Shut down
U S Steel	166	11	11	0	0	Shut down
Valley Camp of Utah	357	290	203	181	209	Operating
TOTALS	5228	2937	2651	2477	2725	

2.13-4 Suggested Action Items

Original recommended action items as identified in the study have been performed by the Permittee and Utah Fuel Company management personnel as follows:

Scofield and the Pleasant Valley Area

- Encourage the two (and possibly more) mining companies in Pleasant Valley to begin working on agreements to cooperate with each other and assist the local officials in solving existing problems.

- Hold an information exchange meeting with Scofield residents.

- Make a thorough investigation of the Utah Special Service District, which could provide many of the necessary community services to the mining companies and communities.

- Implement one of several housing assistance measures.

Response:

The Permittee and Valley Camp of Utah, Inc., being the owners of the two operating coal mines in the area, have cooperatively worked together and finalized agreements on land leases and land exchanges. Cooperative agreements have been formulated to jointly participate in the construction of the Eccles Canyon highway and also jointly share, under an agreement with each other and UDOT, snow removal maintenance costs on the highway. The road agreements have been especially beneficial to local residents in providing them with year round safe travel between SR96 and SR31. This well maintained highway (SR-264) provides year round access to local and state residents for summer and winter recreational and business activities.

Both the Permittee and Valley Camp of Utah officials have cooperatively worked closely during the past five years with Scofield-Pleasant Valley residents and elected officials in the following manner:

- Regularly attended Scofield Town Council meetings

- Are represented and regularly attend monthly meetings of the Pleasant Valley Committee (PVC). The PVC is composed of all representative users and city, county, state, and federal agencies in the Pleasant Valley area.

- Are or have finalized participating contracts with the Town of Scofield to participate in the newly proposed Scofield sewer project

- Have worked closely with the PVC and the Department of Wildlife resources in local stream improvements, by providing materials, labor, equipment, and technical expertise. Utah Fuel Company received a commendation from the American Fisheries Society for their extensive services rendered toward stream improvements resulting in significant fish migration and propagation.

The Permittee and Utah Fuel Company have participated in Scofield Town's Annual Pleasant Valley Days celebration with floats and other types of support.

Utah Fuel Company has assisted Scofield Town by grading and paving certain streets to eliminate dust, and also have constructed and installed permanent fence gates, enabling Scofield to control traffic to their sanitary land fill.

The Permittee has been actively involved throughout the entire planning stage of the Scofield sewer project, and actively assisted Scofield's representatives in receiving favorable consideration and grant approvals from the Utah State Community Impact Board.

There appears to be adequate housing available in the Pleasant Valley area, since there are several homes and property for sale, so there has been no reason to pursue the recommended housing assistance measure.

Until just recently, the Scofield Town Council has maintained a building moratorium on new home construction in the community.

The Sanpete Valley Communities

- Hold an information meeting in Fairview or Mt. Pleasant to inform local officials of the mining program and establish communication points.

- Monitor the housing situation in Fairview, Mt. Pleasant, and perhaps Spring City; and develop a dialogue with housing developers.

- Monitor school construction in North Sanpete School District. Provide updated employment information from time to time.

- Monitor hospital needs in the Sanpete Valley. Coordinate the mine manning schedule with local plans for a new hospital.

- Monitor water requirements, especially in Fairview.

- Request a copy of the tabulation of the Fairview resident survey.

Response:

Permittee's management officials have held several informational meetings with the local elected officials, including State Legislators, Mayors and County Commissioners of Sanpete county to keep them apprised of progress and plan changes occurring at the

Skyline Mines. Contact with the identified community leaders has been on-going throughout the Skyline Mines' progress by the Permittee's Governmental Affairs Director.

As elected officials are replaced, contact is made after each election, where changes take place, to ensure good lines of communication are maintained.

Initial contacts were made with housing developers in the Fairview and Mt. Pleasant areas, but projected housing shortages in Sanpete county communities never materialized.

Several meetings were held with both North and South Sanpete School District Superintendents to keep them updated on the Permittee's development progress. New larger school buildings have been constructed for the elementary, middle and high school grade levels; and educational facilities are more than adequate to meet educational needs for the foreseeable future.

As realistic manning schedules for the Permittee's Skyline Mines began to solidify, it became apparent that the mine's future hospital needs would not impact the Sanpete Valley Hospital in Mt. Pleasant. Hospital officials were apprised of the Applicant's manning schedules as construction and mine development progressed. A new hospital was constructed in Mt. Pleasant in May of 1984 with a 20 bed capacity, and is administered under the Intermountain Health Care directorship.

The Permittee discussed, with Sanpete County and community leaders in a community meeting, the status of their various water systems and community needs. Special attention was given to Fairview community's water situation.

Fairview, during Skyline mine development, has upgraded their water system significantly through funding from the State Community Impact Board. These community assistance grants and loans have enabled Fairview and other Sanpete communities to install new feeder and water distribution lines, and also enabled Fairview to drill a deep well to augment their canyon spring water supply. Fairview now has a state approved culinary water system.

A copy of the Fairview resident survey tabulation was procured and evaluated by the Permittee.

Carbon/Emery Area

- Hold an information meeting in Price to inform local officials of progress and to establish communication points.
- Monitor essentials such as housing, water, sewage system, and capacity of new hospital.

Response:

Permittee held an informational meeting in the Price area in 1980 and 1981 with local, county, and state elected officials, who were updated as to the progress of the Skyline Mines construction and development phases.

Communication points were established as follows: Senator Omar Bunnell and Representative Mike Dmitrich from the State Legislature; James Simone, Chairman of the Carbon County Commission; and Mayors Walter Axelgard of Price and Charles Ghirardelli of Helper.

A similar informational meeting was held in Emery county, and local and county elected officials were updated on Skyline Mines' construction and development phases.

It was agreed that future contact people would be Mayor Drew Richards of Huntington City and the Emery County Commissioners: Gardell Snow, Chairman, of Ferron; Glen E. Jones, Huntington; and Rue P. Ware, Orangeville.

Permittee met at regular intervals with County Planning and Zoning officials and Price River Water Improvement District officials to apprise them of Skyline Mines' progress, and also to keep abreast of housing, water, and sewer developments.

Contacts were initially made with John Harris, Carbon Hospital Administrator, and also Don Larsen, Castle View Hospital Administrator. Mr. Larsen indicated that the new hospital has an 88 bed capacity - an increase of 18 beds over the old facility. The new hospital also has significant state-of-the-art technology and specialized medical services that were not offered in the old hospital.

2.13.5 Comprehensive Study Program

The Permittee conducted a comprehensive study of the social, economic, and community impacts associated with the development of the Skyline Mines. W. Robert Richards, Housing and Community consultant, 2210 Arcadia Place, Masting, California 94553, was contracted to conduct the study to assess the current and future impacts on the four county service area communities.

Mr. Richards did an in-depth analysis of the construction and mining work force, the residential patterns, the community infrastructure associated with the identified work force, housing, transportation, and recreation impacts of the Skyline Mines. His conclusions were that in the stages of construction and early mine development there would be no significant impacts on the area's work force, housing, and recreation due to the limited numbers and wide dispersion of employees. Subsequent studies have, of course, reflected this same finding, since employee numbers at Skyline Mines have remained far below predicted manpower levels and community infrastructure facilities have been significantly improved.

The Permittee hand carried copies of the comprehensive study and reviewed same with the County Commissions from Carbon, Emery, Sanpete, and Utah Counties; the Mayors of the major municipalities in the effected counties; the Southeast Utah Association of Government officials; members of the State Legislature representing the four county service areas, and the regulatory authorities, DOGM and OSM. Recipients were encouraged to refer any questions to the Permittee and any comments to the regulatory agencies for appropriate follow-up.

Housing and company bussing were identified as possible mitigation measures, depending on projected growth scenarios for the service area.

Housing

Housing was felt to be adequate for the next two years (through 1983) if the current manpower demands remained constant and anticipated large power projects such as the Emery Gasification plant or Carbon-Emery power plants did not start construction.

None of these projected plants have materialized, and manpower demands have not remained constant; in fact they have declined significantly, (see Table 2.13-11, Manpower Needs Comparison - 1981-1985) creating a vast reservoir of unemployed workers to draw upon. In fact, Carbon, Emery, and Sanpete counties are classified as depressed areas.

The Intermountain Power Project (IPP) started initial construction on its number 1 & 2 plants in October of 1981, and announced in 1982 that proposed plants 3 & 4 were being cancelled. About that same time, Utah Power and Light cancelled its Number 4 Hunter plant. Fortunately for Carbon, Emery, Sanpete, and Utah counties, the IPP project did proceed with construction, since its coal contracts with the Permittee has enabled the Skyline Mines to continue development and increase operations.

The Intermountain Power Project is obtaining or will obtain coal from the following coal mines: Andelax (formerly Tower Resources), Plateau Mining Company, U.S. Fuel, the Skyline Mines, and Southern Utah Fuel Company. Without IPP as a customer, it is questionable whether all of the above mines would be viable operations, at least at the production levels now anticipated.

Bussing

The Permittee committed to providing free bus transportation service to the Skyline mine employees, and has, under its personal ownership, provided busses from Carbon, Sanpete, and Utah Counties.

Experience has shown that company bussing is very successful. Employee participation and satisfaction is high, averaging about 95% usage. It is a safe mode of worker transportation that provides convenient year round access from the multi-county service areas.

The Permittee has made and continues to make conscientious efforts to participate in organized, multi-municipal, county and regional efforts to keep such entities informed as to Skyline Mines' activities, and address community or county concerns relative to our Skyline mining operations. The Permittee has finalized a contract with the Scofield Town officials to assist the community by participating in their proposed Scofield-Pleasant Valley sewer project. Scofield Town has formed a Pleasant Valley Sewer Advisory Board and the Permittee has a representative on that Board to provide technical expertise and make recommendations to the Board and the Scofield Town Council regarding the sewer system operation.